SYSTRON DONNER
A THORN EMI company

6202A

INSTRUCTION MANUAL

MODEL 6202A
FREQUENCY COUNTER

SERIAL NO.

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YSTRON DONNER

CONCORD INSTRUMENT DIVISION
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TABLE OF CONTENTS

CHAPTER 1 - GENERAL INFORMATION		Page
1.1	Introduction	1-1
1.2	Specifications	1-1
1.3	Options	1-2
1.4	Logic Symbols and Notations	1-3
CHAPTER 2 - INSTALLATION		
2.1	Introduction	2-1
2.2	Receiving Inspection	2-1
2.3	Reshipment	2-1
2.4	Power Requirements	2-2
CHAPTER 3 - OPERATION		
3.1	Introduction	3-1
3.2	Front Panel	3-1
3.3	Rear Panel	3-2
3.4	Accuracy of Measurement	3-4
3.4.1	Oscillator Stability	3-4
3.4.2	Gating Error	3-5
3.5	Operating Procedures	3-6
3.5.1	Line Power Requirements	3-6
3.5.2	Rate Measurements	3-6
3.5.3	Total Measurements	3-6
CHAPTER 4 - PRINCIPLES OF OPERATION		
4.1	Introduction	4-1
4.2	Logic Devices	4-2
4.3	Circuit Descriptions	4-2
4.3.1	A1, Logic Assembly	4-2
4.3.2	A2, Power Supply Assembly	4-4
4.3.3	A3, Readout Assembly	4-5
4.3.4	A4, Oscillator Assembly	4-5
CHAPTER 5 - MAINTENANCE		
5.1	Introduction	5-1
5.2	Test Equipment	5-1
5.3	Performance Verification	5-2
5.4	Cover Removal	5-3
5.5	Calibration	5-3
5.5.1	A4, Oscillator Assembly, Calibration	5-3
5.5.2	Alternate Oscillator Calibration Method	5-3
5.5.3	A2, Power Supply	5-4
5.5.4	A1, Logic Assembly	5-4
5.6	Routine Maintenance	5-5
5.7	Printed-Circuit Board Repair	5-5

TABLE OF CONTENTS (Cont'd)

		Page
CHAPTER 6 - DRAWINGS		
6.1	Introduction	6-1
053558	Test Assembly	6-3
053736	Chassis Assembly	6-4
053554	Front Panel Assembly	6-5
053568	Case Assembly	6-5
7-053550	Wiring Interconnect Schematic	6-6
05362101	A1, Logic Assembly	6-7
05367101	A2, Power Supply Assembly	6-9
7-05367101	A2, Power Supply Schematic	6-9
045586-4-3	A3, Readout Assembly	6-10
045586-7-3	A3, Readout Schematic	6-10
045604-4-1	A4, Oscillator Assembly	6-11
045604-7-1	A4, Oscillator Schematic	6-11
CHAPTER 7 - REPLACEABLE PARTS LIST		
7.1	Introduction	7-1
7.2	Manufacturer's Index	7-1
7.3	Replaceable Parts List	7-4
CHAPTER 8 - STANDARD OPTIONS		
8.1	Introduction	8-1
Opt 06/07	Battery Pack Assembly	
Opt 08	TCXO Oscillator Assembly	8-13
Opt 15	Seven-Digit Readout Assembly	8-17
Opt 31	Rear Input Assembly	8-21
Opt 35	BCD Output Assembly	8-25
CHAPTER 9 - SUPPLEMENTAL INFORMATION		
9.1	Introduction	9-1

LIST OF FIGURES

Figure	1.1	Definition of Logic Levels	1-3
	3.1	Front Panel Function	3-3
	3.2	Rear Panel Function	3-3
	3.3	Gating Ambiguity	3-5
	4.1	Functional Block Diagram	4-1

LIST OF TABLES

			Page
Table	1.1	Specifications	1-1
	1.2	Standard Options	1-2
	3.1	Front Panel Functions	3-1
	3.2	Rear Panel Functions	3-2
	5.1	Recommended Test Equipment	5-1
	7.1	Code-To-Name Cross-Reference	7-1

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

The Systron-Donner Frequency Counter Model 6202A fits all 20 Hz to 5 MHz counter applications, filling the need for making frequency measurements in industrial plants, on production lines, in school laboratories, in telephone service units, in the field, and in systems.

The autoranging resolution fills the display register within time base limits while automatically selecting maximum frequency resolution. By depressing the MANual switch, the operator can manually select measurement readings with resolutions in four decade steps. By activating the TOTALize switch, the counter will totalize counts over an indefinite period. Starting or stopping any measurement mode can be accomplished manually or by remote control.

The readout is highly reliable, seven segment, parallax free display. This readout of six standard and one optional digit features zero suppression which blanks out the leading zeros for easier measurement comprehension.

1.2 SPECIFICATIONS

Table 1.1 lists the specifications applicable to the Model 6202A. Standard options available for the instrument are listed in Table 1.2.

TABLE 1.1 SPECIFICATIONS

FREQUENCY MEASUREMENT	
Range:	20 Hz to 5 MHz.
Sensitivity:	25 mV rms to 1 MHz; 50 mV rms, 1 MHz to 5 MHz.
Resolution:	
Auto:	1 Hz to 100 Hz in decade steps.
Manual:	0.1 Hz to 100 Hz selectable in decade steps.
Accuracy:	±1 count ±time base accuracy.
Display:	kHz with autopositioned decimal point.
TOTALIZE	
Rate limits:	20 Hz to 5 MHz.
Register Capacity:	10^5 events.
Totalize/Hold:	Manually operated front panel switch.

TABLE 1.1 SPECIFICATIONS (Cont'd)

INPUT CHARACTERISTICS	
Input Impedance:	1 MΩ shunted by 35 pF.
Coupling:	ac
Attenuation:	Continuously variable.
Maximum Input:	Without Damage: 500V peak (dc + ac component). 250V rms, 20 Hz to 10 kHz. 50V rms, 10 kHz to 5 MHz.
STANDARD TIME BASE	
Aging Rate:	±3 parts in 10^7 per month.
Temperature Stability:	±5 parts in 10^6 from 0 to 50° C; typically ±2 parts in 10^6 from 20° to 40° C.
Line Voltage:	±1 part in 10^7 for 10% line variation.
External Input:	100 kHz to 2 MHz, 1V rms into 500 Ω. 1 MHz for proper numerica and measurement unit display.
GENERAL	
Display:	6 digits standard (7 digits optional).
Display Storage:	Provides continuous display of last reading.
Power:	100, 115, 200, 230 Vac, ±10%, 48 to 400 Hz; approximately 10W.
Dimensions:	8.26 cm x 17.78 cm x 20.64 cm. (3 1/4" H x 7" W x 8 1/2" D).
Weight:	2.27 kg (5 lbs), net; 3.40 kg (7 1/2 lbs) shipping.

1.3 OPTIONS

Table 1.2 contains a list of the standard options available for the Model 6202A Frequency Counter.

TABLE 1.2 STANDARD OPTIONS

Option	Description
06	Battery Pack - 4 hour operating cycle with built-in recharging circuit. Increases height to 7 inches.
07	DC Operation - Permits operating from external dc

TABLE 1.2 STANDARD OPTIONS (Cont'd)

Option	Description
	power source of +5.5 to +7.5 Vdc @ 2 A with the addition of an internal power inverter.
08	Time Base Oscillator - Improves time base temperature stability to ±1 part in 10^6 from 0 to 50°C.
15	Additional Readout Digits - Adds one readout digit to display.
31	Rear Input BNC - Connects a rear panel input parallel to the front panel input.
35	BCD Conversion Cable - Converts group-serial BCD outputs from the Model 6202A into standard 8-4-2-1 parallel format, including decimal and legend units. Compatible for use with the Systron-Donner Model 5103 Digital Printer.
Rack Mounting	Provides for rack mounting the instrument in either single or dual mount installation.

1.4 LOGIC SYMBOLS AND NOTATIONS

Since most of the integrated circuit modules used in this instrument are DTL/TTL compatible, most signal levels are 0.0 V to 0.8 V LOW (L) and +2.4 V to 5.0 V HIGH (H) (See Figure 1.1). Symbols used conform to MIL STD 806B.

The active state of logic line is identified with the absence or inclusion of bar notation over the signal name. For example: RESET: indicates a high-level condition producing the active state of reset. $\overline{\text{RESET}}$: indicates a low-level condition producing the active state of reset. In general, an open line to a logic symbol is considered a HIGH.

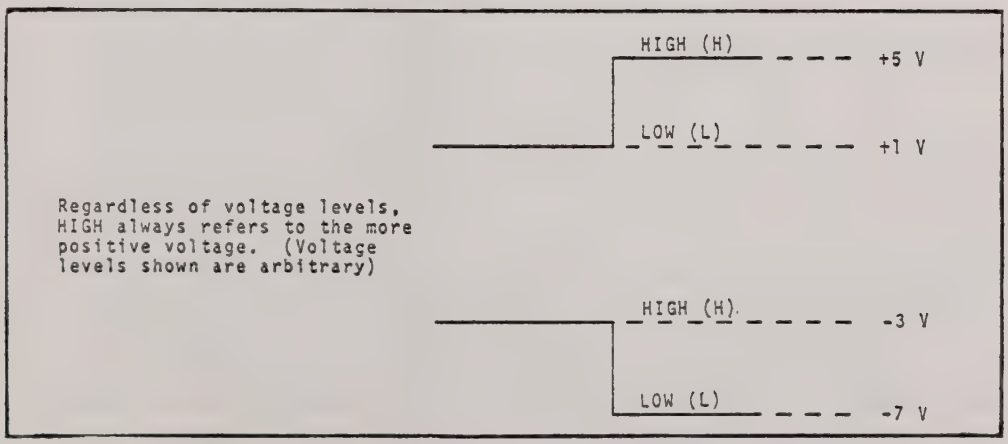


FIGURE 1.1 DEFINITION OF LOGIC LEVELS

CHAPTER 2
INSTALLATION

2.1 INTRODUCTION

The SD Model 6202A Frequency Counter is shipped in an operational condition and is essentially ready for use as received. This chapter outlines the procedures for initial inspection and installation of the instrument. Instructions for reshipment are also included should the unit be returned to Systron-Donner Corporation for service or repair.

2.2 RECEIVING INSPECTION

Prior to accepting the counter from the shipper, inspect the condition of the shipping container for any indication of freight damage. Any sign of such damage must be noted by both the shipper and receiver and should be reported to the insurance investigator.

Immediately following removal of the instrument from the shipping carton, inspect for possible physical damage incurred during shipment. Check surfaces for scratches or dents and note condition of controls and connectors. Should any damage be noted, notify your nearest Systron-Donner representative---DO NOT USE THE COUNTER UNTIL INSTRUCTED TO DO SO BY THE REPRESENTATIVE.

2.3 RESHIPMENT

When the instrument is to be repackaged for shipment use the original packing materials. Your Systron-Donner field office can provide materials similar to those used for the original factory packaging, or repackage the instrument following these general instructions:

General packaging instructions:

1) Attach a tag to the unit indicating the model number, serial number, name and address of the instrument owner, and a summary of the service or repairs required.
2) Wrap the instrument in heavy paper or plastic prior to placing it into the shipping container.
3) Select a strong carton or wooden box to house the instrument.
4) Use an adequate layer of shock-absorbing material on all sides of the instrument and protect the front panel with additional layers of cardboard. Be certain that there is no movement of the unit within the container.
5) Seal the package with strong tape or metal bands.

6) Mark the shipping container "FRAGILE-DELICATE INSTRUMENT" to ensure careful handling.

7) Be certain that all correspondence refers to full instrument nomenclature (model and serial number).

2.4 POWER REQUIREMENTS

The Model 6202A Frequency Counter is supplied with a standard three-conductor power cord which, when plugged into an appropriate power receptacle, grounds the chassis to protect operating personnel from certain electrical hazards. Whenever the power cord is mated to a two-conductor outlet, a cord adapter plug (properly installed) will provide the same protection.

The instrument operates from either 100, 115, 200, or 230V at 48 to 440 Hz and consumes approximately 10W of power. Taps on the primary of the power transformer are provided to accommodate these power line requirements. The instrument is shipped with a .5 ampere fuse internally installed; this fuse is for all power input levels.

Prior to connecting the power cord to a line source, ensure that the transformer jumpers are properly connected for the available line voltage. See Test Assembly drawing #053558, or Power Supply Schematic #7-05367101 for jumper connection and Section 5.4 for cover removal.

CHAPTER 3
OPERATION

3.1 INTRODUCTION

Operation of the instrument is covered in this chapter. A functional description of the front and rear panel controls, connectors, and indicators is followed by step-by-step operating procedures.

3.2 FRONT PANEL

The controls, connectors, and indicators located on the front panel of the instrument are described in Table 3.1. Figure 3.1 shows the location by index number.

TABLE 3.1 FRONT PANEL FUNCTIONS

Index	Name	Function
1	ON	Pushbutton switch, applies power to the instrument when depressed.
2	RESOLUTION	
	AUTO	Pushbutton switch, interlocked with the MAN switch, when depressed, places the instrument in autorange.
	MAN	Pushbutton switch, interlocked with AUTO switch, manually sequences the time base from 0.1 Hz to 100 Hz.
2	RATE	Pushbutton switch, interlocked with TOTAL switch, selects frequency mode of operation when depressed.
4	TOTAL	Pushbutton switch, interlocked with RATE switch, totalizes events. When depressed the gate is opened to begin totalization. When again depressed, the switch closes the gate to stop totalization and hold the display.
5	RESET	Momentary pushbutton switch; manually resets instrument to zero when depressed. When released, the instrument will begin a new counting cycle.

TABLE 3.1 FRONT PANEL FUNCTIONS (Cont'd)

Index	Name	Function
6	INPUT	BNC connector accepts the input to be measured.
7	SENSITIVITY	Rotary knob controlling a potentiometer; clockwise rotation increases sensitivity.
8	TRIGGER LEVEL	Screwdriver adjustment controlling a potentiometer; clockwise rotation moves level offset more positive.
9	Readout/kHz	LED indicator shows the units, kHz, when in the rate mode of operation. Does not light in the total mode.
10	Readout/Digits	Seven-segment readout indicators show the measurement data with decimal point location.
11	Readout/OFF SCALE	LED indicator lights when the readout exceeds 99999.
12	Readout/GATE	LED indicator flashes to show the opening and closing of the gate.

3.3 REAR PANEL

The controls and connectors on the rear panel of the instrument are described in Table 3.2. Figure 3.2 shows the locations by index number.

TABLE 3.2 REAR PANEL FUNCTIONS

Index	Name	Function
1	1 MHz	BNC connector accepts an external time base 100 kHz to 2 MHz, 1V rms into 500 Ω. Must be 1 MHz for proper numerical and measurement unit display.
2	EXT/INT	Slide switch selects either the internal time base or an external time base applied to the 1 MHz BNC connector.

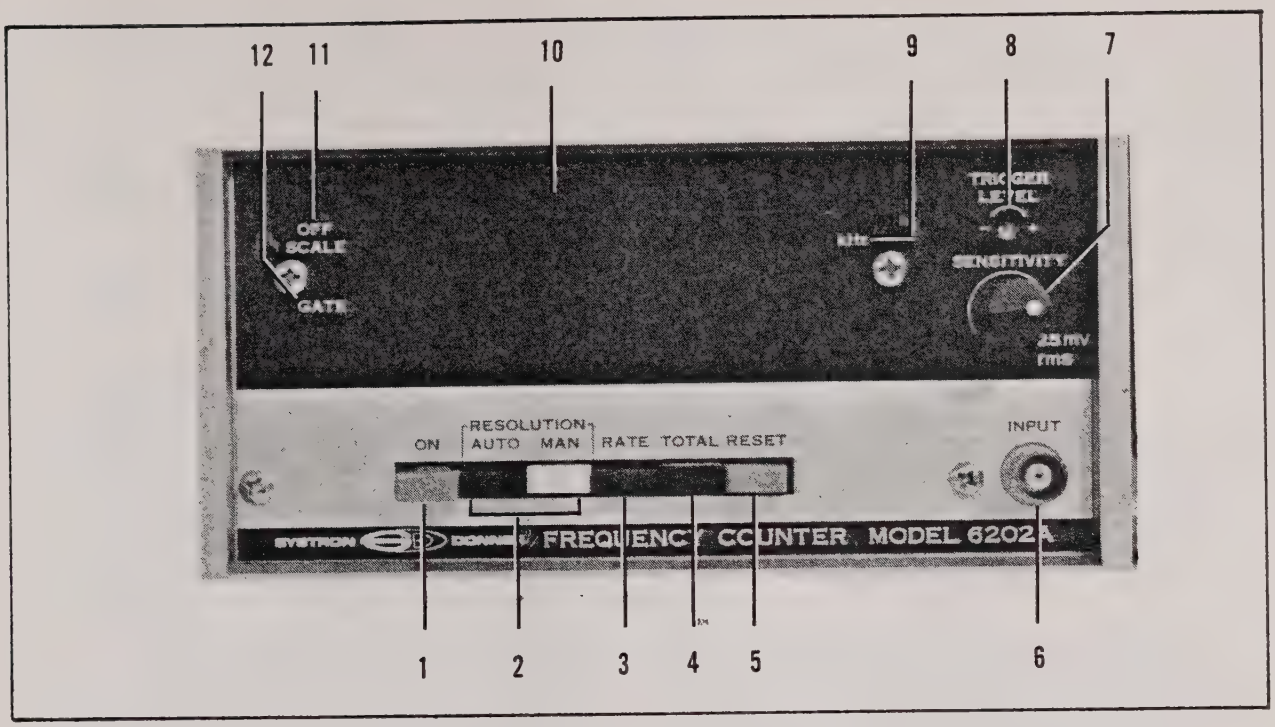


FIGURE 3.1 6202A FRONT PANEL

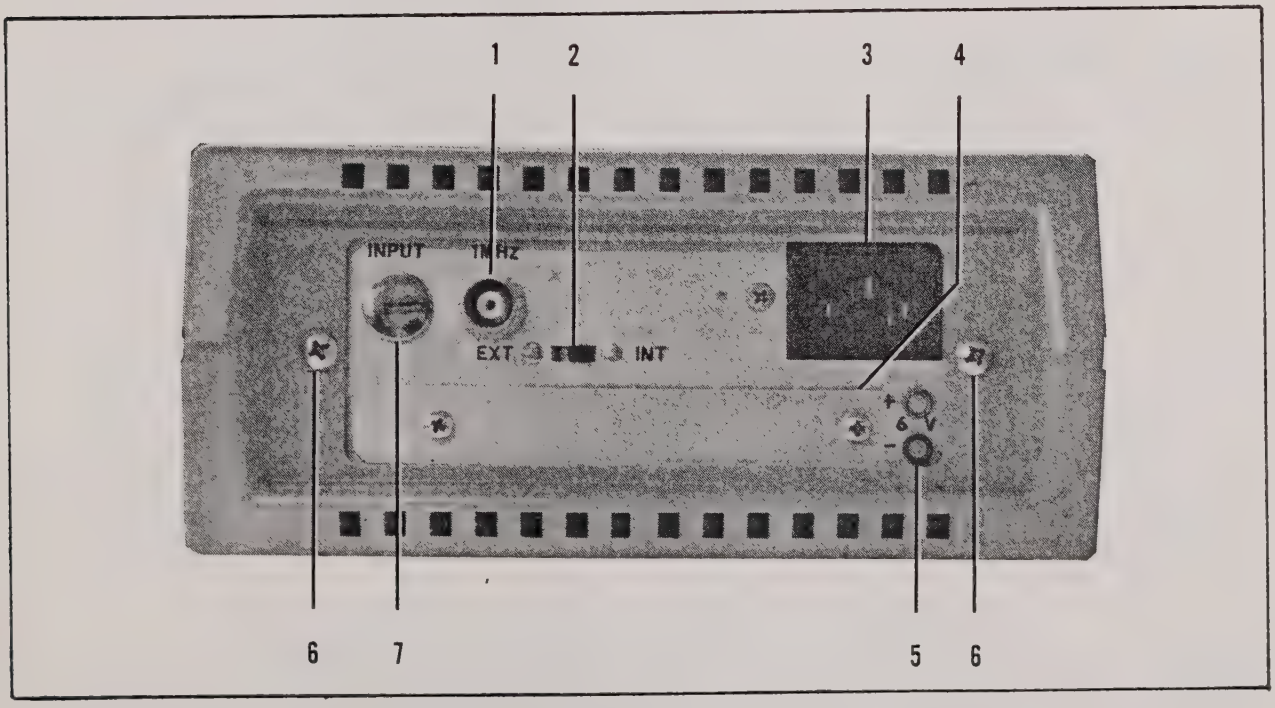


FIGURE 3.2 6202A REAR PANEL

TABLE 3.2 REAR PANEL FUNCTIONS (Cont'd)

Index	Name	Function
3	Power Socket	Three prong receptacle provides for ac power cord connection to the instrument.
4	Cover Plate	Option 35, BCD conversion cable outlet.
5	+ 6 V -	Optional connectors for battery operation, Option 06 or Option 07.
6	Screws, mounting	Case retainer screws. Unfasten for cover removal.
7	INPUT (Cover Plate)	Optional BNC connector allows rear panel input of measurement data. Option 31.

3.4 ACCURACY OF MEASUREMENT

Two factors which may cause measurement errors in the Model 6202A are oscillator stability and gating error. Methods of minimizing these errors are contained in the discussions below.

3.4.1 Oscillator Stability

The gating precision, and, therefore, the accuracy of the count, is dependent upon the stability of the internal oscillator.

In the standard instrument, the oscillator is initially set to within ±1 part in 10^7 of a 1 MHz frequency standard having at least an order of magnitude higher stability.

Deviation of the oscillator from this frequency then becomes a function of several factors; the most significant being time. Due to certain processes in the frequency determining elements of the oscillator, an "aging" rate is established that can be measured and specified for the oscillator. This aging rate is specified to the less than ±3 parts in 10^7 per month. Generally, this aging rate decreases with time (providing the instrument remains continuously energized). The error due to oscillator instability may be estimated from:

$$\text{Max \% error} = (\pm 3/10^7 \times M) \times 100$$

where: M is the number of months since last calibrated.

Oscillator stability is also a function of line voltage and temperature. To achieve the highest accuracy of measurement, the following

considerations apply:

1) Maintain the instrument plugged-in and continuously energized.
2) Maintain constant environmental conditions.
3) Monitor or regulate line voltage.
4) Calibrate instrument at intervals consistent with maximum allowable error.

3.4.2 Gating Error

All types of digital measuring instruments are subject to an irreducible ±1 count ambiguity in the least significant digit of the display. This error is possible because the signal counted is not coherent (synchronized) with the time base pulses that control the signal gate. As illustrated in Figure 3.3, the first or last cycle of the input signal may, or may not, pass through the signal gate during the selected measurement interval.

As the measured frequency is increased, the percent of error due to the ±1 count ambiguity is reduced, since it becomes less significant compared to the total count. In any case, the maximum percentage of error is a function of the frequency measured and the number of pulses counted; i.e., the time base selected, and may be expressed by:

$$\text{Max \% error } (\leq 100\%) = \frac{1}{f \times T} \times 100$$

where: f is the frequency measured in Hz and T is the selected time base in seconds. Thus, to measure 1 MHz with a maximum gating error of ±0.001%, a 10 Hz resolution must be utilized.

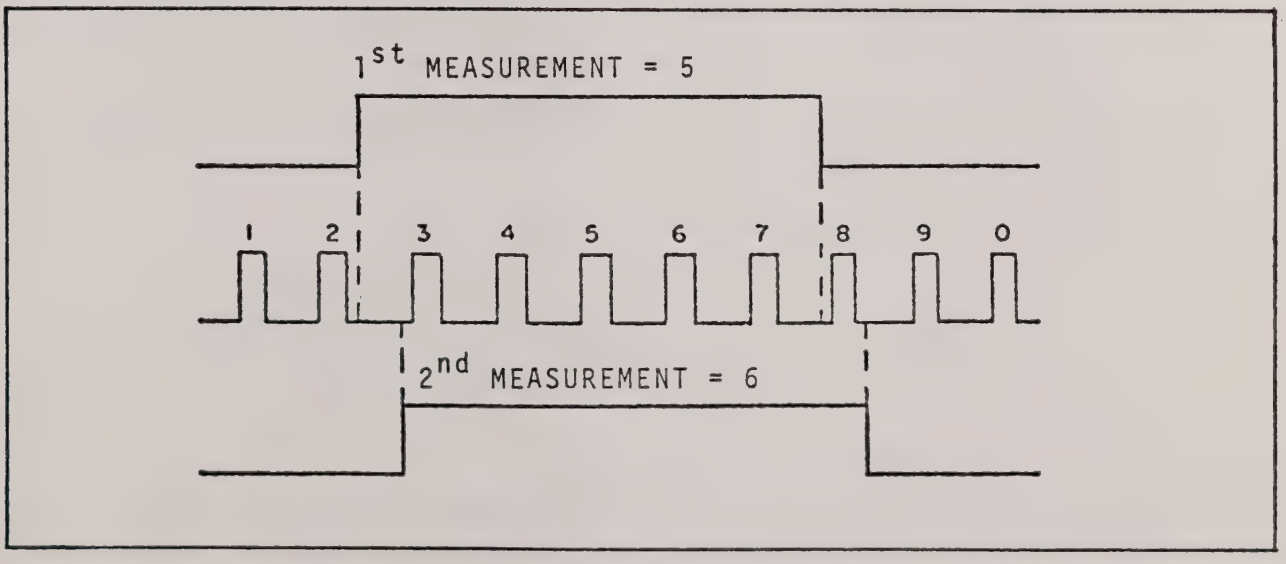


FIGURE 3.3 GATING AMBIGUITY

3.5 OPERATING PROCEDURES

The instrument may be operated in either the RATE mode or TOTAL mode. In the RATE mode, sine wave or pulsed frequencies within the range of the instrument may be measured. Either automatic or manual resolution can be selected. Automatic resolution selects the appropriate time base for the frequency being measured. By sequentially depressing the manual resolution switch, the operator can select the desired resolution from 0.1 Hz to 100 Hz in decade steps.

3.5.1 Line Power Requirements

Check to ensure the jumpers on the transformer taps are set correctly for the line voltage available. See Test Assembly drawing #053558 and Power Supply Schematic #7-05367101.

3.5.2 Rate Measurements

To measure a sine wave or repetitive pulse from 20 Hz to 5 MHz, use the following procedure:

1) Ensure the instrument is connected to the correct line voltage.
2) Depress the ON switch.
3) Depress the RATE switch.
4) Depress the AUTO switch if automatic resolution is desired. For manual resolution, successively depress the MAN switch until the desired resolution is obtained.
5) Rotate the sensitivity control counterclockwise.
6) On the rear panel, position the EXT/INT switch to INT; or, position the switch to EXT and connect an external time base signal, 1V rms into 500 Ω, to the 1 MHz BNC connector.
7) Connect a signal, minimum 25 mV rms, to input BNC connector. Rotate SENSITIVITY control clockwise for a stable reading.
8) Momentarily depress RESET.
9) Read the frequency on the display.

NOTE

When measuring pulsed frequencies, it may be necessary to adjust the TRIGGER LEVEL Control to offset the polarity of the pulses.

3.5.3 Total Measurements

This mode of operation allows the input events to be totalized or

accumulated. The gate is manually opened by momentarily depressing the TOTAL switch and closed by again depressing the switch. The display is held until the gate is reopened or the RESET switch is depressed. Use the following procedure to make a measurement in the TOTAL mode:

1) Depress the ON switch.
2) Rotate the SENSITIVITY control counterclockwise.
3) On the rear panel, position the EXT/INT switch to INT; or, position the switch to EXT and connect an external time base, 1V rms into 500 Ω, to the 1MHz BNC connector.
4) Connect a signal, 25 mV rms minimum, to the INPUT BNC connector.
5) Depress the TOTAL switch.
6) Depress the RESET switch.
7) When finished totalizing depress the TOTAL switch and read the total events on the display.

CHAPTER 4
PRINCIPLES OF OPERATION

4.1 INTRODUCTION

The Model 6202A Frequency Counter measures the frequency of a signal or the total number of signal pulses. The measuring technique compares the frequency of an unknown signal to a time base derived from a reference frequency.

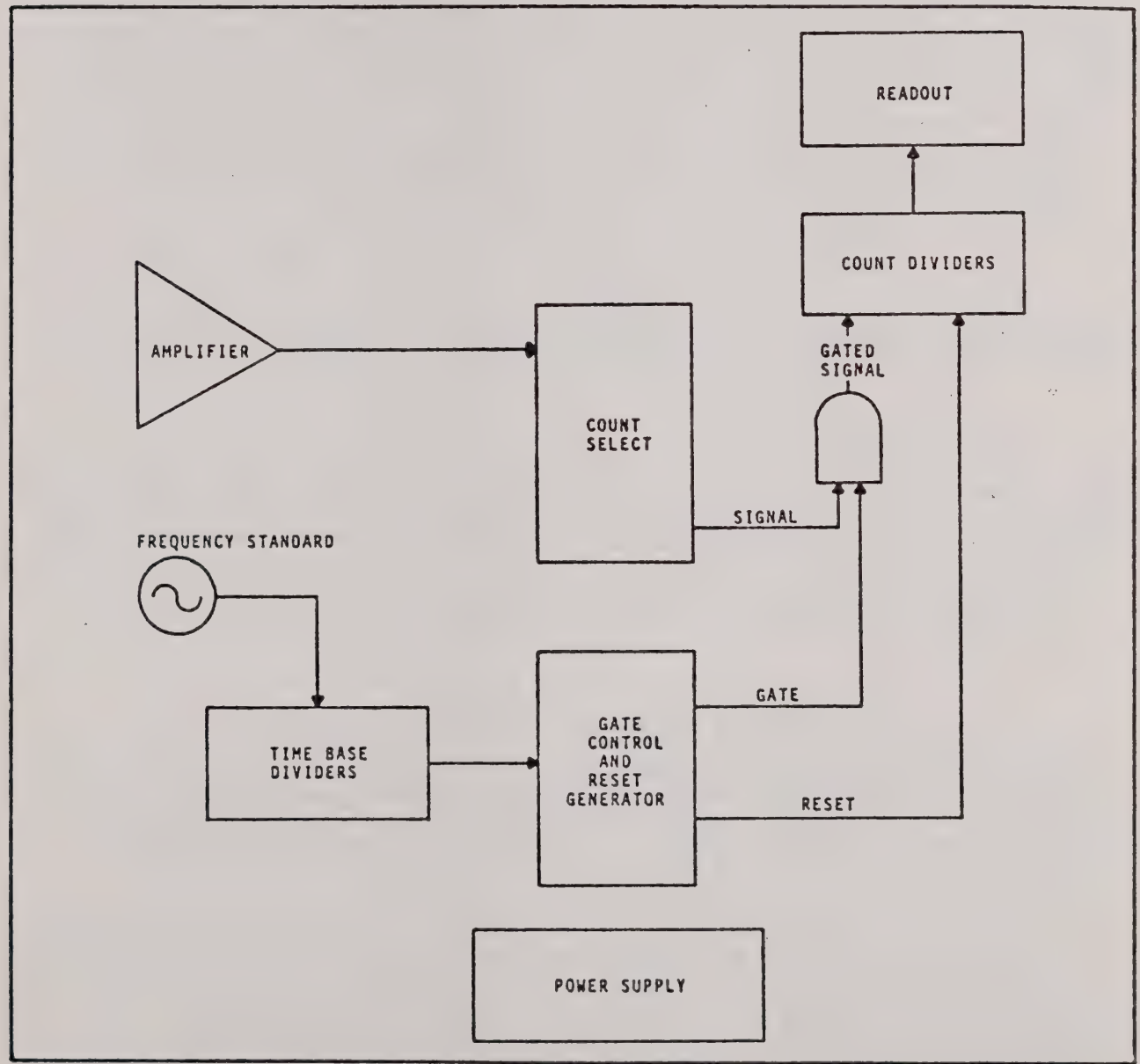


FIGURE 4.1 FUNCTIONAL BLOCK DIAGRAM

Figure 4.1 is a functional block diagram of the instrument. The system consists of front panel controls, input amplifier shapers, function select logic, function control logic, time base, oscillator reference, decade counters, readout unit, and power supply. The switches on the front panel connect the appropriate circuit for the measuring function. The resolution switches select a time base reference signal. The combined positions of the two switches determine the proper decimal point placement in the readout.

When an unknown signal is connected to the instrument, the input amplifier-shaper converts the signal into a rectangular waveform. The rectangular waveform is directed to the decade counters when the count gate is opened by the selected time base. The serial data is converted into BCD format by the decade counters. The BCD data is then decoded into decimal outputs by the decoder driver which drives seven-segment readout tubes that indicate the measurement. Display time of the measurement, independent of gate time, is approximately 100 ms. The readout unit continuously displays the latest measurement at the end of each gate time.

4.2 LOGIC DEVICES

Logic assembly schematic #7-05362101 contains a list of typical integrated circuit devices contained in this instrument.

4.3 CIRCUIT DESCRIPTIONS

The following circuit descriptions are arranged in alpha-numeric order according to assembly number. Abbreviated reference designators are used rather than the full reference designation. For example, A1U25, on the logic assembly, is referred to as U25. Connector designators are referenced in the same manner; pin 6 on connector J4 is referred to as J4-6. Interconnect wiring is shown on Wiring Interconnect Schematic #7-053550

4.3.1 A1, Logic Assembly (Schematic #7-05362101)

The logic assembly consists of eight interdependent circuit groups; input amplifier-shaper, time base, resolution select, count chain, multiplex, decimal and legend logic, off scale, and gate light circuits. For clarity of presentation, each circuit is described independently.

Input amplifier-shaper: Signal input is through the sensitivity control to gate 1 of dual gate MOSFET, Q1. Bias is controlled by potentiometer R8 to provide an output of 2.0 Vdc when measured at TP1. Q1 and Q2 provide impedance matching and Q3, Q4, Q5, Q6 is the amplifier section. Trigger level potentiometer, located on the front panel, controls the bias on the base of Q5 and sets the trigger level for the wide band amplifier. The output of Q5, Q6, is routed through Schmitt trigger, U1, to the decade counters, when the gate is open.

Totalize: If the totalize mode is selected, the resolution select circuits are disabled. Depressing the TOTAL switch clocks U18, which opens the count gate. The count gate will remain open until the TOTAL switch is again depressed. The low from the RATE switch holds the transfer gate U23-3 high, so the count is continuously available for display. The decimal point and legend circuit is not operational.

Resolution Select: When in the RATE mode of operation, resolution may be selected manually or automatically. For manual selection, each time the MAN switch is depressed, flip-flop U34-8, 11, will trigger and the pulse through U26-8 to U30-6 will step the resolution, in decade steps, from 100 Hz to 0.1 Hz. The binary output of U30 is applied to U29 as a coded time base control signal. The 1 MHz clock drives the time base chip, U29. The output from U29 clocks U16, allowing the next 1 MHz clock pulse to be passed through as the start or stop pulse.

The resolution circuit is composed of U30 and the associated logic. U30 is a programmable binary counter element. Each pulse through pin 6 will change the output one binary bit. The programmed binary state will be transferred to the output when the strobe, pin 1, is held low. When the AUTO switch is depressed, U26-8 is disabled. The low at U30-4 is coupled through U30-5, enabling U17-11, 8, and disabling U33-11. The first clock pulse through U16-5, start, steps the binary output of U30 to the 100 Hz resolution position through U17-8, U26-11. Each following pulse will step, one decade at a time, through the resolution positions unless U17-8 is disabled.

U17-8 may be disabled in one of two ways. If the next-to-most significant digit carries prior to the next clock pulse, the pulse through U22-6, U26-6, and exclusive OR gate U31-3 will reset U30-5 and disable U17-8. If the binary output of U30 reaches the 1 Hz resolution output, the BCD outputs on pins 12, 2, are coupled through U26-3. The circuit U26-6, and exclusive OR gate U31-3 is both pulse sensitive and level sensitive. The level change at U26-6 will be coupled through as a pulse to reset U30-5. In either case U33-11 is enabled. The next clock pulse through U16-5 will be the stop pulse, and the system will reset.

Time Base: The timing circuit consists of programmable counter, U29, dual D edge flip-flops U16, U32, monostable flip-flops U27, U19, and the associated logic and circuitry. U29 is programmed by the binary output of U30 and counts the 1 MHz input from the oscillator through U17-3. The first pulse through U16-5 is gated through U33-3 as the start pulse and through U17-6 to put a low at U16-9. The low at U16-2 will disable U16-5. When U29 times out, the pulse through U22-4 will clock U16-9 and enable U16-5. The next pulse through U16-5 will then be the stop pulse.

The pulse through U33-3 clocks U32. U32-9 goes high and the high through U35-6, 8, turns the count gate on. This also clocks U32-5 to the high level. The low from U32-8 holds U23-6 high. At this point, U27-5, 4, are high and U19-13 is low. When U29 times out, the stop pulse clocks U32-9 low turning the count gate off. U32-5 does not clock, so the high at U32-8,5, drives U23-6 low. The low from U23-6

drives U27-4 low, sending the transfer pulse through U23-3 to U25 and the decade counters. The pulse is also routed through U33-8 and the resulting low from U31-8 triggers U27, which triggers U19. The high through U12-8 clears and presets the decade counters to the 15 count. The low from U19-4 clears the timing circuit making it ready for the next cycle.

Decimal and Legend Logic: Information is selected by U25 and U24. The BCD from U30 is applied to U25 and stored until the enable pulse is applied. U24, the BCD to decimal decoder, developes a one-of-ten condition to identify the decimal location. Decimal information is applied to the readout assembly through U23-11, 8, and U22-12. This information is applied to the decade counters through inverters U22-2, 10, 8, and logic elements U10, U11, and U12. Blanking is achieved by sensing the "8" and "4" outputs of the decade counters. At reset, the decade counters to the left of the decimal are set to "15". The first counter pulse will change the output to "1" and the counters will then count from "1" through "0". As each counter is strobed, the "8" and "4" output lines are sensed by U34-3, and, if the "8" and "4" outputs are present, a blanking pulse is developed and applied to the four-to-seven segment decoder on the readout assembly.

Count Chain: The count chain consists of tri-state decade counter-storage devices, U2 through U6. The outputs are paralleled for multiplex purposes. Multiplex is accomplished by free-running oscillator U-15, clock register U14, and decoder U13. The decoder times the sequence of multiplexing. The readout is interlaced multiplex for a proper visual indication.

Off Scale is sensed by U21 and U20. When the most significant digit carries, U21 toggles, setting U20-3, 8. The next transfer pulse will drive U21-9 positive and Q8 will turn on the Off Scale light. The gate light drive, for extending the short time base conditions, is provided by U19-C31. The true gate and extended gate are summed in U20-11 for proper drive to Q7.

4.3.2 A2. Power Supply Assembly (Schematic #7-05367101)

The power supply furnishes regulated +5 Vdc, -12 Vdc, +180 Vdc, and unregulated +9 Vdc. The supply assembly consists of line filter, L1, L2, C1, C2, transformer T1, three bridge rectifiers and regulating modules U1, VR1, and associated circuitry. The +9 Vdc is regulated to +5 Vdc by module U1 mounted on the rear panel. The -18 Vdc is regulated to -12 Vdc by U1 mounted on the assembly and Q2 mounted on the rear panel. +200 Vdc is regulated to +180 Vdc by Q1 and VR1.

The +180 Vdc is used for operation of the display tubes while the +5 Vdc and -12 Vdc is distributed throughout the instrument for circuit operation.

4.3.3 A3, Readout Assembly (Schematic # 045586-7-3)

The readout assembly contains the display, display decoder-driver, measurement units indicator, decimal decoder-driver, off scale indicator, and gate indicator.

The readout display includes five in-line horizontal tubes of the neon-filled cold-cathode discharge type. As the cathodes are grounded, the elements ionize the gas and produce the display. Current through the tubes is limited by the decoder-driver, U2.

The decoder-driver accepts a binary-coded decimal input, from the logic board, and converts the information to an output suitable for grounding the display tube cathodes. The blanking pulse is developed on the logic board by ANDing the BCD "4" and "8" together.

The anodes of the seven-segment readout tubes are activated by a sequenced level, timed to turn the various anodes on, applied to Q1 through Q9, at a time the cathodes are coded correctly. This multiplexing occurs at a frequency of approximately 2 kHz.

The measurement unit indicators, gate light, and off-scale light accept ground signals from logic elements on the logic board and convert them to a visual output on the annunciator unit.

The decimal driver, U1, accepts BCD information from the decimal logic and converts it to one-of-ten outputs suitable for lighting the decimals contained within the display tubes.

4.3.4 A4, Oscillator Assembly (Schematic # 045604-7-1)

The 10 MHz oscillator consists of a quartz crystal, Y1, controlling a Colpitts circuit. Transistors Q2 and Q3 amplify the 10 MHz output and apply it to decade counter, U2. The 1 MHz output of U2 is applied to U1-13 and ANDed with the input from the EXT/INT switch on the rear panel. When in the INT position, U1-12 is high and the 1 MHz time base is applied to A1, pin 1.

An external standard, applied to the rear panel BNC connector, may be used as the time base when the switch is in the EXT position. U1-11 is disabled and U1-3 is enabled. The external standard is then applied as the instrument time base. To obtain the proper numerical and measurement unit readout from the instrument, the external time base must be 1 MHz.

CHAPTER 5
MAINTENANCE

5.1 INTRODUCTION

When the instrument requires service, the nearest Systron-Donner representative should be contacted. He can provide field service or arrange for factory returns, when necessary. Address all inquiries on operation or applications to your nearest sales representative; or, Sales Manager:

SYSTRON-DONNER CORPORATION
CONCORD INSTRUMENT DIVISION
10 Systron Drive
Concord, California 94518
Phone: (415) 676-5000
TWX: 910-481-9479
Cable: SYSTRONDONNER

Specify both model and complete serial number in all correspondence.

5.2 TEST EQUIPMENT

Test equipment recommended for maintaining and checking performance is listed in Table 5.1. Equivalent test equipment having similar characteristics may be substituted when necessary.

TABLE 5.1 RECOMMENDED TEST EQUIPMENT

Type	Characteristic	Recommended type
Digital Voltmeter	0.1% dc - 1% ac	SD Model 7005A
Signal Generator	10 Hz to 10 MHz	HP Model 651B
Pulse Generator	1 Hz to 50 MHz	SD Data Pulse Model 116
Frequency Standard	1 MHz Output	General Technology Model 304B
Oscilloscope	80 MHz Bandwidth, Plug-in type	Tektronix Model 581

5.3 PERFORMANCE VERIFICATION

This test may be used to determine calibration/repair requirements or to check the instrument after calibration/repair has been accomplished. Operation and performance of all circuits in the instrument can be verified by the following procedures:

1) Set the Counter Controls:

ON	Depress
RESOLUTION	AUTO
RATE	Depress
SENSITIVITY	Maximum clockwise
EXT/INT (rear panel)	INT

2) Connect the 10 Hz to 10 MHz signal generator to the INPUT BNC connector on the counter. Adjust the signal generator for an output of 5 MHz at 50 mV rms. Observe the display is 5000.0 kHz to generator accuracy.

3) Vary the frequency output of the signal generator in a random manner from 5 MHz to 20 Hz. Maintain the signal level at 25 mV rms below 1 MHz, 50 mV rms 1 MHz to 5 MHz. Observe the proper indications on the display.

4) Depress the RESET and observe the display goes to zero.

5) Adjust the signal generator to a frequency of 1 kHz, 25 mV rms amplitude. Successively depress the MANual switch to step through the four resolution positions.

Resolution (Hz)	Display
100	1.0 kHz
10	1.00 kHz
1	1.000 kHz
.1	1.0000 kHz

All readings ±1 count.

6) Connect the pulse generator to the INPUT BNC connector. Adjust for a positive pulse, 1 µs width, 80 mV amplitude at a rate of 100 Hz.

7) Depress the AUTO switch. Adjust the TRIGGER LEVEL as required. Indication should be .100 kHz ± dial accuracy.

8) Change pulse generator output to a negative pulse. Adjust TRIGGER LEVEL as required. Indication should be .100 kHz ± dial accuracy.

9) Connect the signal generator to the instrument. Adjust for an output of 5 MHz. Maintain signal level at 50 mV rms.

10) Depress the TOTAL switch.

11) Depress the RESET switch and observe the display goes to zero.

12) Depress the TOTAL switch and observe the instrument resumes counting.

13) Depress the RESET switch and observe the display goes to zero and the gate light goes out.

14) Depress TOTAL switch and observe instrument resumes counting.

15) Allow the instrument to continue counting and observe the OFF SCALE lamp turn on as the display goes from 99999 to 00000.

5.4 COVER REMOVAL

1) Disconnect the line power cord.

2) Remove the two case retaining screws on the rear panel and slide the instrument from the case.

WARNING

Dangerous voltages are exposed when the instrument is connected to line voltage with the case removed. Use caution when performing adjustments or operating the instrument in this condition.

3) To replace the chassis, reverse the above procedure.

5.5 CALIBRATION

The oscillator assembly, A4, is the only assembly in the instrument which requires calibration on a routine basis. Periodic adjustment is required in order to maintain specified accuracy of the instrument.

5.5.1 A4, Oscillator Assembly, Calibration

1) With the case installed, depress the ON switch. When operating temperature is achieved, set the counter controls:

RATE	Depress
MAN	Depress
SENSITIVITY	As Required
EXT/INT (rear panel)	INT

2) Connect the 1 MHz frequency standard to the instrument input connector. Maintain a minimum amplitude of 25 mV rms.

3) Successively depress the MANual switch to obtain a .1 Hz resolution.

4) With a small screwdriver, inserted through the rear cooling port on the input side of the case, adjust variable capacitor, C10, for a reading of (100) 00000 kHz ±1 count. OFF SCALE indicator should be lit.

5.5.2 Alternate Oscillator Calibration Method

1) Remove the instrument case.

2) Connect the power cord to the line voltage. Depress the ON switch and position the EXT/INT switch to INT.

3) Connect the 1 MHz frequency standard to the EXT input of the oscilloscope. Monitor the output of the oscillator, A4 pin 1.

4) Adjust A4C4 so the waveform momentarily stops moving.

5.5.3 POWER SUPPLY, A2

Although there are no adjustments for the power supply voltages, the following checks must be made to ensure proper operating voltages prior to calibration or repair of circuits:

1) With the digital voltmeter make the following resistance measurements:

   a) Line cord disconnected, power switch off; measure across power pins; reading should be infinity.

   b) Power switch ON; reading should be 21 Ω ±5 Ω.

   c) Between ground and chassis, reading should be 0 Ω.

   d) Connect digital voltmeter negative lead to chassis, positive lead to +5V bus. Reading should be 169 Ω ±30 Ω.

   e) Connect digital voltmeter negative lead to chassis positive lead to -12V bus. Reading should be 780 Ω ±30 Ω.

   f) Connect digital voltmeter negative lead to chassis, positive lead to +180V bus. Reading should be 2000 Ω ±200 Ω.

2) Connect the ac line cord to a 117V 60 Hz source.

3) With the digital voltmeter measure between ground and +5V. Measurement should be +5V ± 0.2 Vdc.

4) Measure between ground and -12V. Measurement should be -12V ±1.5 Vdc.

5) Measure between ground and +180V bus. Reading should be +180V ±10 Vdc.

6) With the oscilloscope, monitor the +5V and -12V power supplies for 120 Hz ripple. Ripple should be less than 10 mV.

5.5.4 Logic Assembly, A1

1) Rotate the sensitivity control fully counterclockwise.

2) Connect the digital voltmeter between ground and TP1.

3) Adjust the BIAS potentiometer, R8, for a reading of +2 Vdc +100 - 0 mV.

4) Connect the signal generator to the input and adjust for an output of 2 MHz with an amplitude of 100 mV rms.

5) Adjust TRIGGER LEVEL for a stable reading of 20000.0 kHz ± dial accuracy ±1 count.

6) Slowly decrease input signal and adjust SENSITIVITY control until best sensitivity is achieved.

5.6 ROUTINE MAINTENANCE

A regular program for maintenance and inspection every five to six months is recommended for this unit. As part of these regular procedures, the instrument should be checked in the following manner:

1) Disconnect ac power and remove the case.

2) Make a thorough visual inspection of all wiring and cables. Check for frayed, loose, or burned wires.

3) Check the physical integrity of all components. Look for burned or cracked components, loose solder connections, leakage of insulation compounds, and general physical damage. When a printed-circuit board contains integrated-circuit packages, ensure that all packages are firmly mounted. Never unnecessarily remove and replace a package.

4) Check all front panel switches and controls for loose or broken terminals, loose or sticking shafts, etc.

5) If the internal panel surfaces and components have an excessive amount of dust deposited on them, use a soft brush and low-pressure stream of air to remove the foreign material.

CAUTION

Do not clean P. C. boards or small internal components with a stiff brush or solvents, since damage to the circuits may result. A high-powered vacuum cleaner device should not be used on small internal components.

6) Wipe the external surfaces of the instrument with a soft, damp cloth to remove dirt, fingerprints, and other foreign materials.

7) Replace the case and reconnect ac power. Check instrument performance in accordance with procedures given in Section 5.3. If performance does not match or exceed the specifications listed in Chapter 1 of this manual, corrective maintenance may be required.

5.7 PRINTED-CIRCUIT BOARD REPAIR

When replacing integrated circuits or other electronic components soldered to printed-circuit boards, the procedures indicated below must be followed or damage to the board may result:

1) Determine, by troubleshooting techniques, which integrated circuit or discrete component(s) has failed.

2) Remove the defective component(s) from the board by cutting the pins or leads with a small diagonal clipping tool. (Always remove and replace the entire component.)

3) Apply heat (40-50W soldering iron) sparingly to each of the cut pins or leads and remove from the board; clean the hole(s) with a toothpick or solder suction tool.

4) Form the tinned leads of the replacement part and insert in the printed-circuit holes; solder, then trim leads to extend 1/16-inch beyond the back surface of the board. (Use only 63-37 solder with maximum 1/16-inch diameter.)

CAUTION

Always trim semiconductor leads only after soldered installation is complete. This procedure greatly lessens the possibility of component failure due to shock-wave damage caused by the trimming tool.

5) When soldering semiconductor devices and all small components, be sure to use a heat sink tool or long-nosed plier connected to the component lead(s) while each is being soldered. Allow the soldered connection to cool before removing the heat sink.

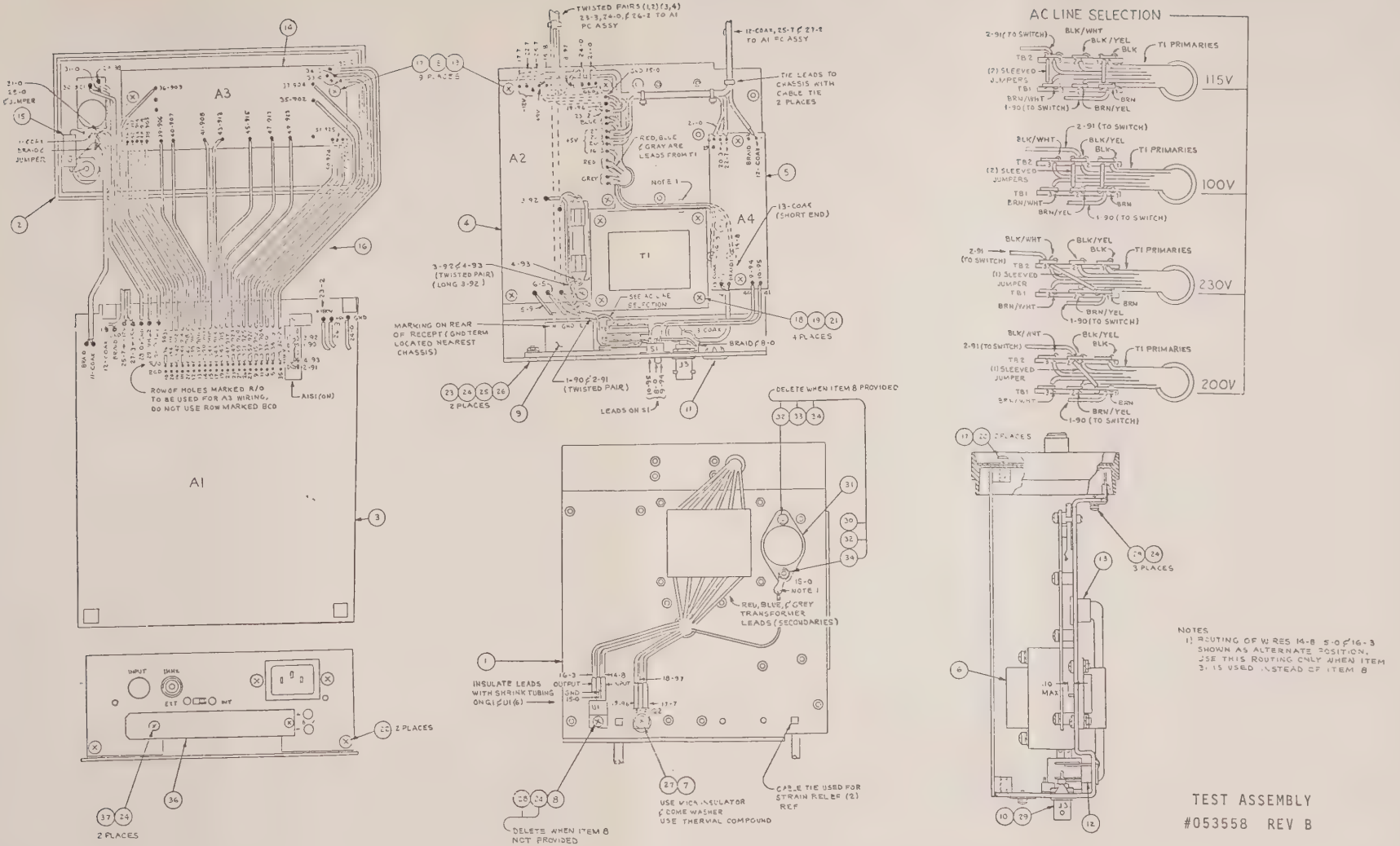
6) Clean all dirt and solder-flux from the printed-circuit traces by liberal application of isopropyl alcohol or freon-type solvents.

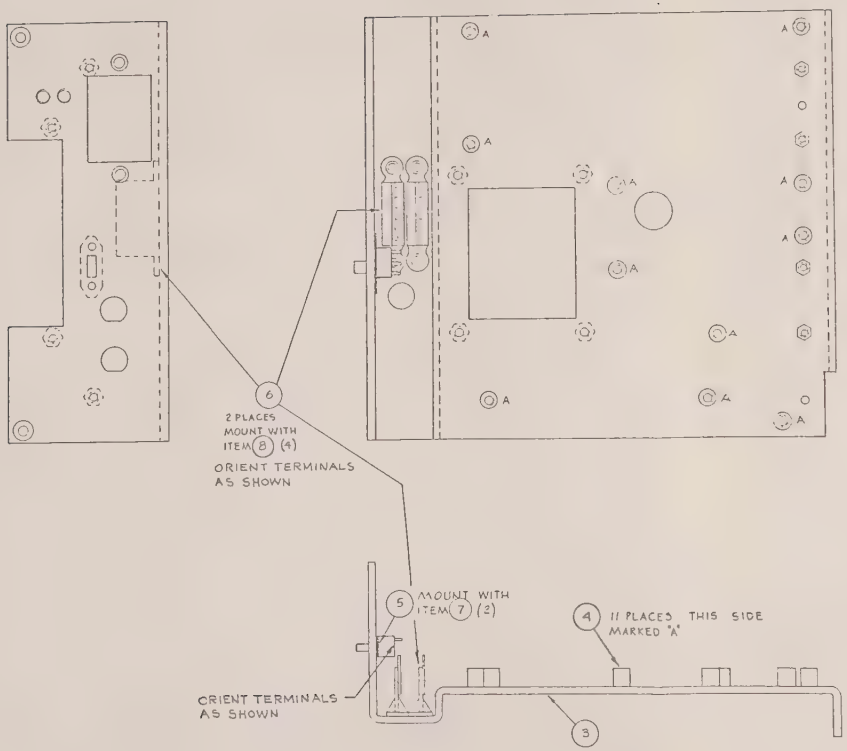
CHAPTER 6
DRAWINGS

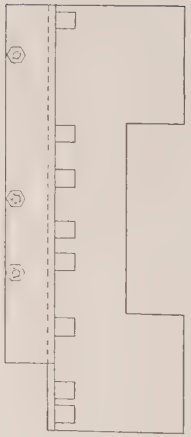
6.1 INTRODUCTION

Assembly and schematic drawings are contained in this chapter. These are arranged with the test assembly followed by the chassis assembly, front panel assembly, case assembly, and wiring interconnect schematic. The "A" numbered board assembly/schematics follow in alpha-numeric order. The list of replaceable parts, in Chapter 7, is arranged in the same manner.

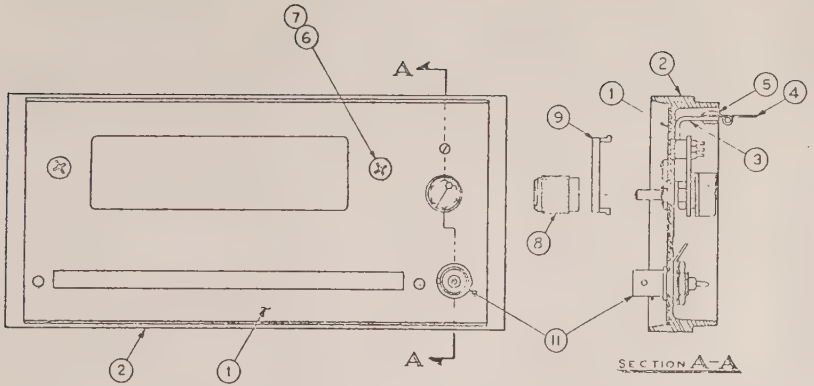
Assembly/schematic drawings and replaceable parts lists for standard options are contined in Chapter 8 and are arranged in a package format.

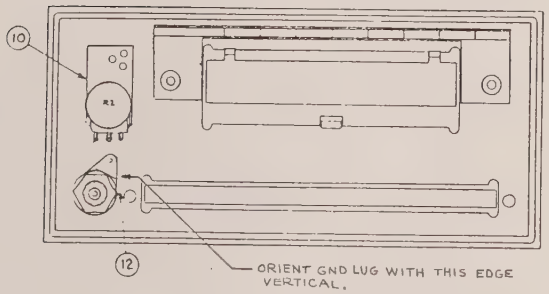

A1
A2
A3
A4
T1
AC LINE SELECTION
115V
100V
230V
200V
TEST ASSEMBLY
#053558 REV B

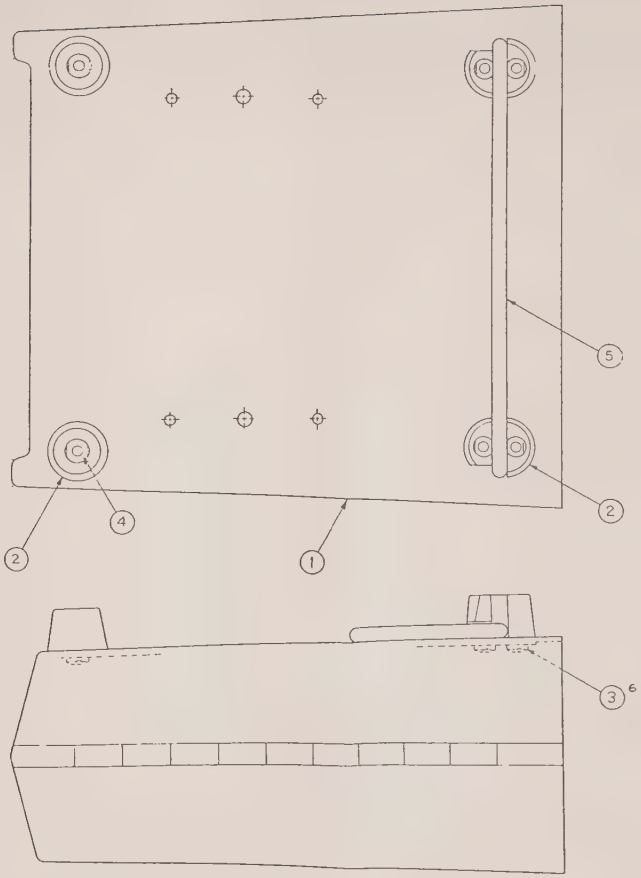




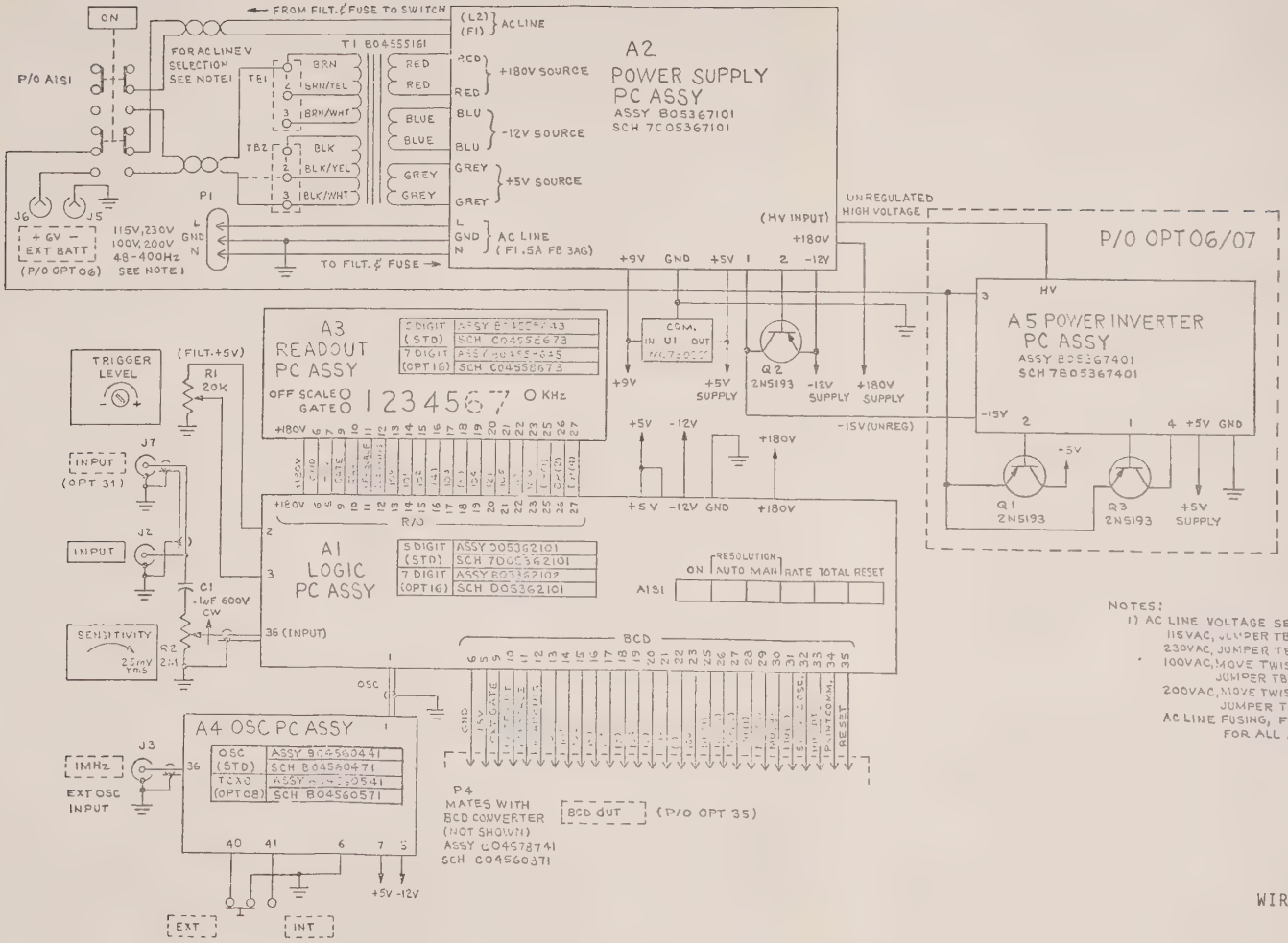
CHASSIS ASSEMBLY
#053736 REV A







FRONT PANEL ASSEMBLY
#053554 REV A
CASE ASSEMBLY #053568 REV A



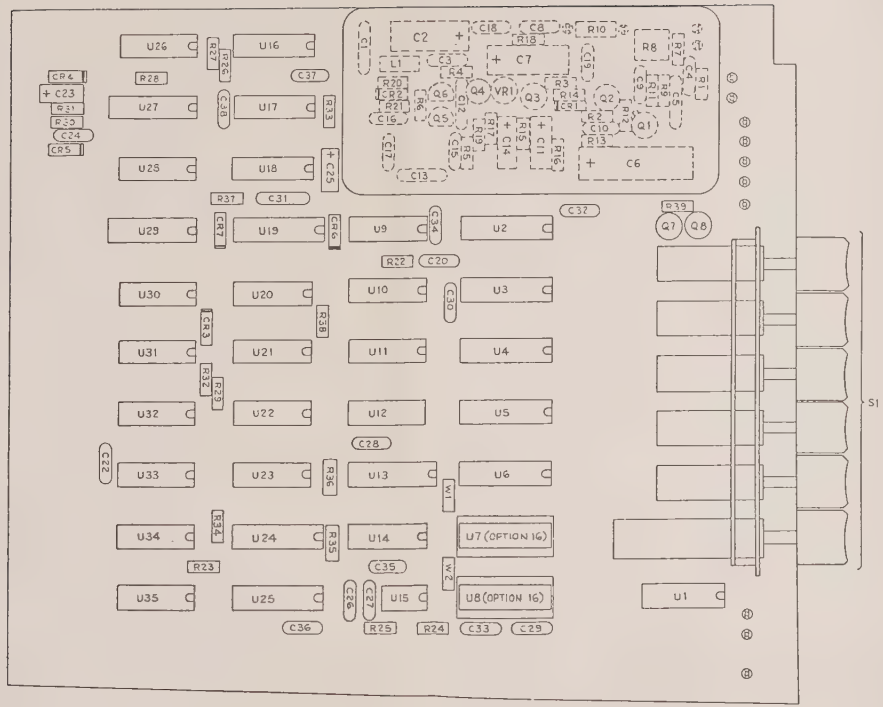
NOTES:

1) AC LINE VOLTAGE SELECTION:
   115VAC, JUMPER TB1-1 TO TB2-1, JUMPER TB1-3 TO TB2-3.
   230VAC, JUMPER TB1-3 TO TB2-3.
   100VAC, MOVE TWISTED PAIR LEAD FROM TB2-3 TO TB2-2, JUMPER TB1-1 TO TB2-1, JUMPER TB1-2 TO TB2-2.
   200VAC, MOVE TWISTED PAIR LEAD FROM TB2-3 TO TB2-2, JUMPER TB1-2 TO TB2-1.
2) AC LINE FUSING, F1 (P/O A2) TO 8 .5A FAST BLO 3AG FOR ALL AC LINE VOLTAGE SELECTIONS.

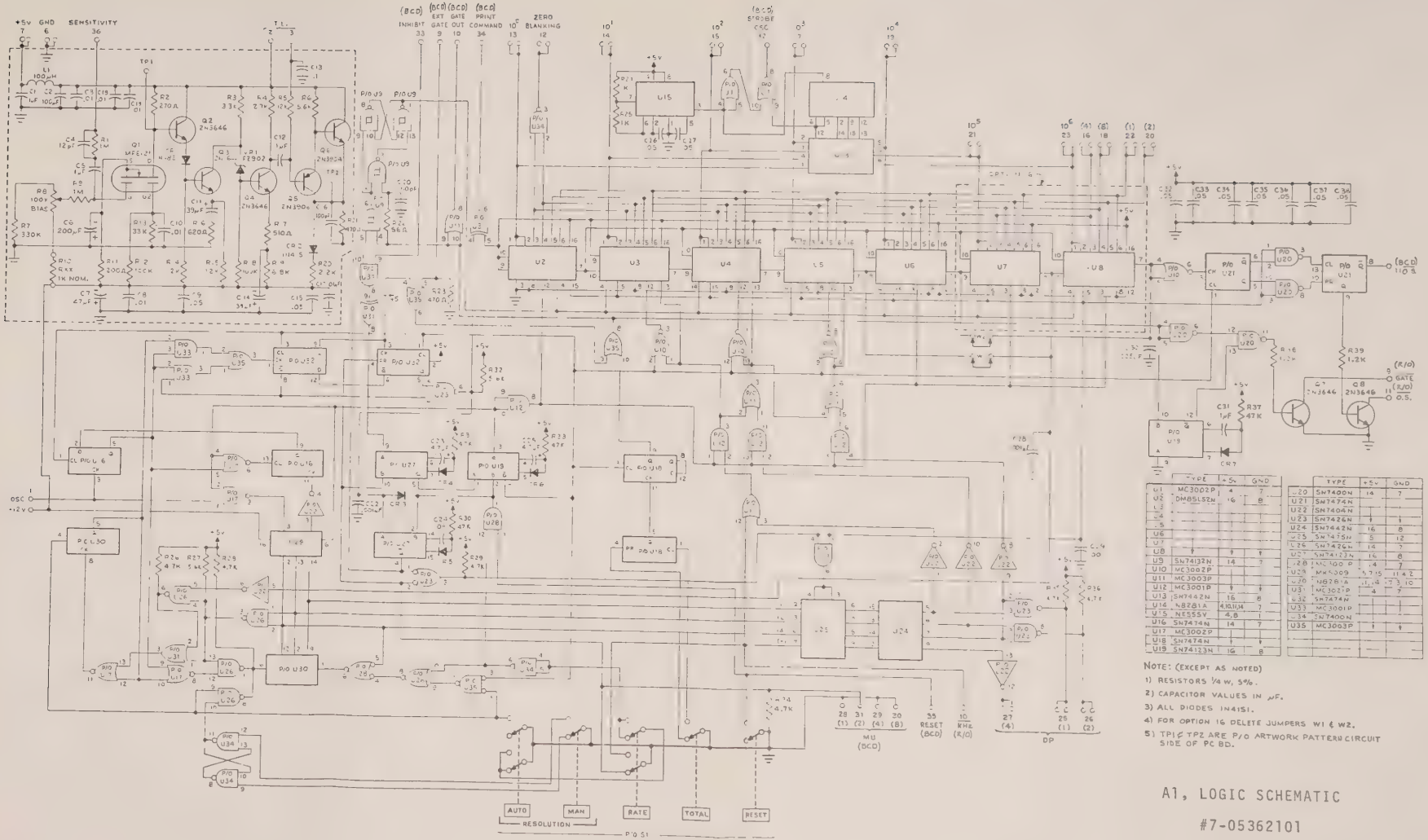
WIRING INTERCONNECT SCHEMATIC

#7-053550 REV B

6202A-9-74



A1, LOGIC ASSEMBLY
#05362101 REV A



	TYPE	+5v	GND
U1	MC3002P	4	7
U2	DM8512N	16	8
U3			
U4			
U5			
U6			
U7			
U8			
U9	SN74132N	14	7
U10	MC3002P		
U11	MC3003P		
U12	MC3001P	9	1
U13	SN7442N	16	8
U14	N8281A	4,10,11,14	7
U15	NE555V	4,8	1
U16	SN7474N	14	7
U17	MC3002P		
U18	SN7474N	1	7
U19	SN74123N	16	8

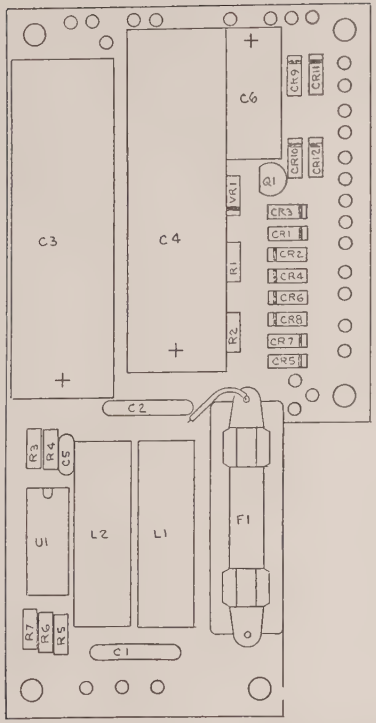
	TYPE	+5v	GND
U20	SN7400N	14	7
U21	SN7474N		
U22	SN7404N		
U23	SN7426N	1	7
U24	SN7442N	16	8
U25	SN7475N	5	12
U26	SN7426N	14	7
U27	SN74123N	16	8
U28	MC3001P	14	7
U29	MK5009	5,7,15	11,4,2
U30	N8281A	11,14	7,3,10
U31	MC3001P	4	7
U32	SN7474N		
U33	MC3001P	1	7
U34	SN7400N		
U35	MC3003P		

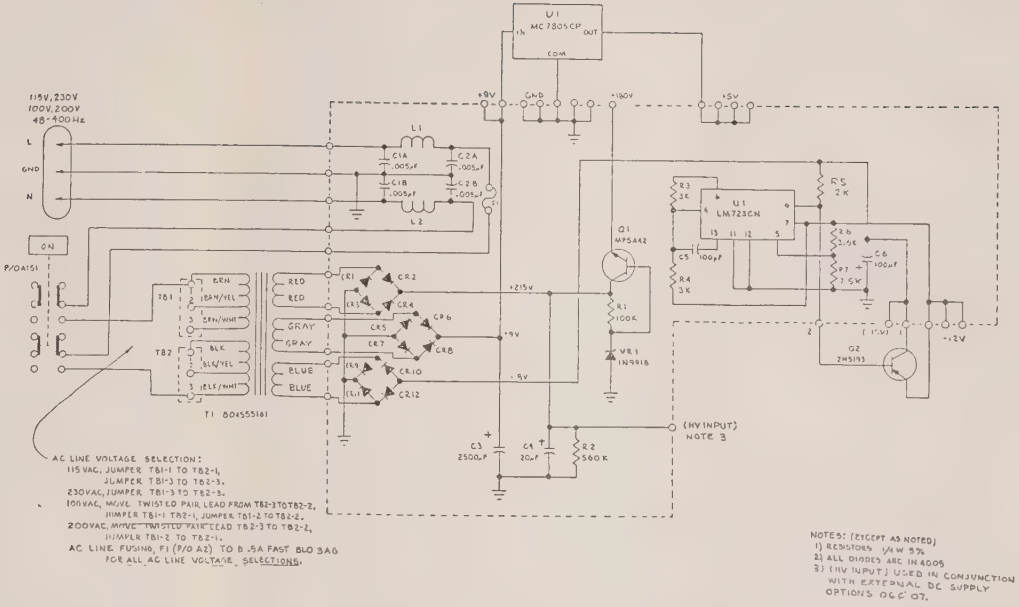
NOTE: (EXCEPT AS NOTED)
1) RESISTORS ¼ W, 5%.
2) CAPACITOR VALUES IN µF.
3) ALL DIODES IN4151.
4) FOR OPTION 16 DELETE JUMPERS W1 & W2.
5) TP1 & TP2 ARE P/O ARTWORK PATTERN CIRCUIT SIDE OF PC BD.

A1, LOGIC SCHEMATIC

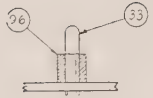
#7-05362101

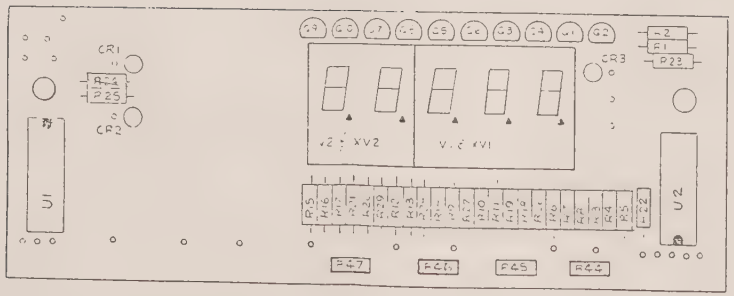
6202A-9-74

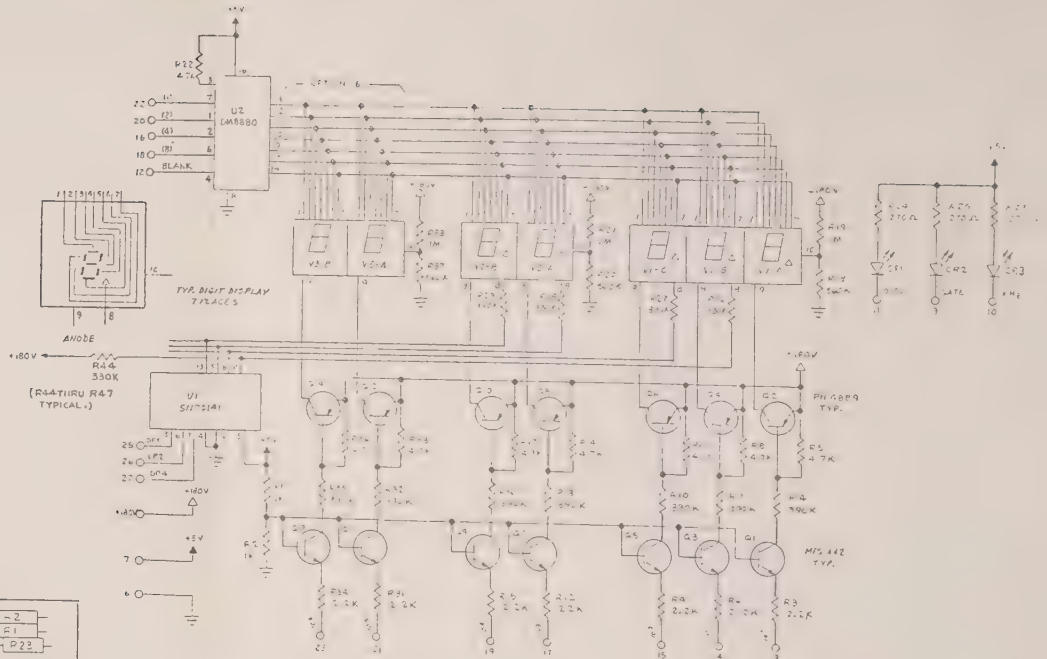




A2, POWER SUPPLY
ASSEMBLY #05367101 REV A,
SCHEMATIC #7-05367101 REV A

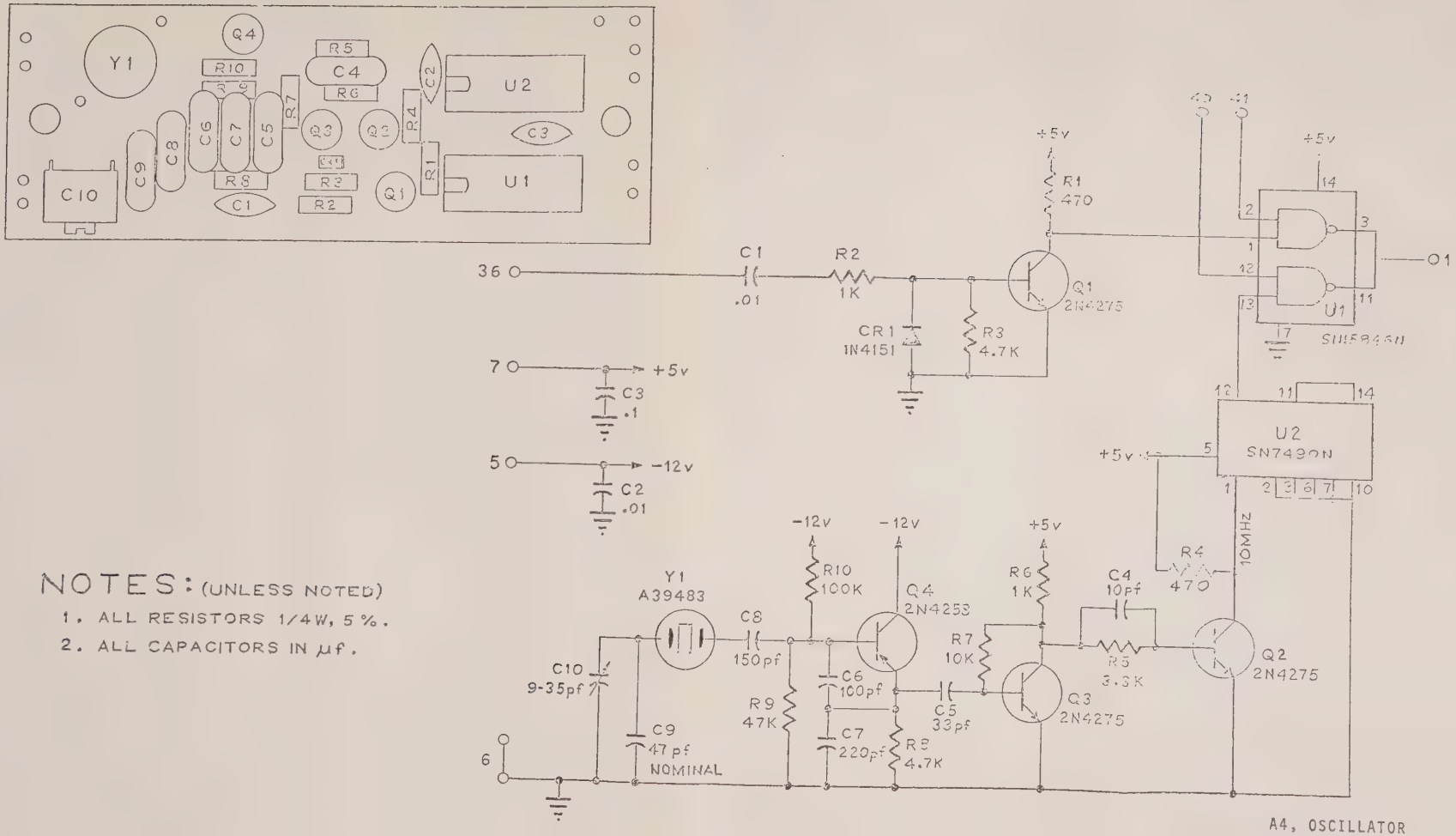






NOTES: UNLESS OTHERWISE SPECIFIED,
1. RESISTORS ARE 1/4 W, 5%.
2. STROBE CODE = 1-4-7-2-5-6-3

A3, READOUT
ASSEMBLY #045586-4-3 REV B,
SCHEMATIC #045586-7-3 REV B



NOTES: (UNLESS NOTED)

1. ALL RESISTORS 1/4W, 5%.
2. ALL CAPACITORS IN μf.

A4, OSCILLATOR

ASSEMBLY #045604-4-1 REV B,
SCHEMATIC #045604-7-1 REV B

CHAPTER 7
PARTS LISTS

7.1 INTRODUCTION

This chapter contains a list of replaceable parts for the instrument. The lists are arranged in order beginning with the final assembly followed by the subassemblies and the "A" numbered boards in numerical order. A manufacturer's code-to-name cross reference is included to assist in obtaining replacement parts.

7.2 MANUFACTURER'S INDEX

TABLE 7.1 CODE-TO-NAME CROSS-REFERENCE

Code	Name	Address
01121	Allen-Bradley Co.	1201 South 2nd St., Milwaukee, Wis. 53204
01295	Texas Instruments, Inc. Semiconductor & Components Div.	13500 N. Central Expressway, Dallas, Texas 75231
03508	General Electric Co. Semiconductor Products Dept.	Electronics Park, Syracuse, New York 13201
04713	Motorola Semiconductor Products, Inc.	5005 East McDowell Rd., Phoenix, Arizona 85008
05704	Alac	Glendale, California
06383	Panduit Corporation	17301 Ridgeland, Tinley Park, Ill. 60477
06540	Amatom Electronic Hardware Division of Mite Corp.	81 Rockdale Avenue New Rochelle, N.Y. 10806
07263	Fairchild Camera & Instrument Corp., Semiconductor Division	313 Frontage Road, Mountain View, CA. 94040
07933	Raytheon Co., Semiconductor Division Headquarters	350 Ellis Street, Mountain View, CA. 94040
13324	Herculite Protective Fabrics, Inc.	1107 Broadway, New York, N. Y. 10010
13715	Fairchild Camera & Instrument Corp., Semiconductor Div., Diode Plant	4300 Redwood Highway, San Rafael, CA. 94903
15933	Systron-Donner Corp., Datapulse Division	10150 W. Jefferson Blvd., Culver City, CA. 90230
18324	Signetics Corporation	811 E. Arques, Sunnyvale, California 94087

TABLE 7.1 CODE-TO-NAME CROSS-REFERENCE (Cont'd)

Code	Name	Address
2160	The Buckeye Stamping Co.	555 Marion Road, Columbus, Ohio 43207
27014	National Semiconductor Corp.	2950 San Ysidro Way, Santa Clara, CA. 95051
27264	Molex Products Co.	5224 Katrine Avenue, Downers Grove, Ill. 60515
28480	Hewlett-Packard Co.	1501 Page Mill Rd., Palo Alto, CA. 94304
50088	Mostek Corporation	1400 Upfield Drive, Carrollton, Texas 75006
52542	Systron-Donner Corporation	10 Systron Drive, Concord, California 94518
56289	Sprague Electronic Co.	North Adams, Mass. 01247
70903	Belden Corporation	415 S. Kilpatrick, Chicago, Ill. 60644
71590	Globe-Union Inc. Centralab Division	P. O. Box 591, Milwaukee, Wisconsin 53201
71785	Cinch Mfg. Co. & Howard B. Jones Division	1026 S. Homan Avenue, Chicago, Ill. 60624
72136	Electro Motive Mfg. Co., Inc.	South Park & John Sts., Willimantic, Conn. 06226
72259	Nytronics, Inc.	550 Springfield Ave., Berkeley Heights, N. J. 07922
72982	Erie Technological Products, Inc.	644 W. 12th Street Erie, Pennsylvania 16512
75915	Littlefuse, Inc.	800 E. Northwest Highway Des Plaines, Ill. 60016
76493	J. W. Miller Company	P. O. Box 5825 19070 Reyes Ave., Compton, CA. 90024
79727	Continental-Wirt Electronics Corp.	26 W. Queen Street Philadelphia, PA. 19144
80294	Bourns, Inc.	1200 Columbia Ave., Riverside, CA. 92507
82389	Switchcraft, Inc.	5555 N. Elston Ave., Chicago, Ill. 60630
83330	Herman H. Smith, Inc.	812 Snediker Ave., Brooklyn, N. Y. 11207

TABLE 7.1 CODE-TO-NAME CROSS-REFERENCE (Cont'd)

Code	Name	Address
88245	Litton Precision Products, Inc., USECO, Division Litton Industries	13536 Saticoy Street, Van Nuys, CA. 91409
91418	Radio Materials Co.	4242 W. Bryn Mawr, Chicago, Ill. 60646
98376	Zero Manufacturing Co., West Division	1121 Chestnut Street Burbank, CA. 91503
99392	S T M	2904 Chapman Street Oakland, CA. 94601
99515	Marshall Industries Capacitor Division	1960 Walker Avenue Monrovia CA. 91016

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION FINAL ASSEMBLY #053550

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
1		ASSEMBLY, Test			053558	
2		CORD, Line	70903	BR-1736	102407	1
3		LABEL, Identification Small	52542	037112	037112	1
4		MOULDING, Lens	52542	04559361	04559361	1
5		ASSEMBLY, Case, Token Standard	52542	053568	053568	1
		ASSEMBLY, CASE #053568				
1		BAIL, Short	15933	32000-716	101057	1
2		FEET, Set, 1 ea left & right front, 2 ea. rear	21604	PP40012&40013	101059	1
3		CASE, Modified	52542	053618	053618	
		ASSEMBLY, TEST #053558				
1		CHASSIS,	52542	053736	053736	1
3	A1	ASSEMBLY, Printed Circuit, Logic	52542	05362101	05362101	1
4	A2	ASSEMBLY, Printed Circuit, Power Supply	52542	05367101	05367101	1
14	A3	ASSEMBLY, Printed Circuit, Readout 5 digit	52542	04558643	04558643	1
5	A4	ASSEMBLY, Printed Circuit, Oscillator	52542	04560441	04560441	1
15	C1	CAPACITOR, Metal Mylar, .1 µf 20%, 600 V	99515	D6-104	100158	1
						1
10	J3	CONNECTOR, BNC	52542	MIL	101155	
9	P1	CONNECTOR, Power, Receptacle, AC	82389	EAC-301	101288	1
7	Q2	TRANSISTOR, Silicon, PNP	04713	2N5193	101405	1
8	U1	INTEGRATED CIRCUIT, Voltage Regulator, 5 V, 1.5 A	04713	MC7805CP	045256	1
11		BUTTON, Plug	8330	652	100840	1
36		COVER, Plate	52542	053829	053829	1
2		ASSEMBLY, Front Panel	52542	053554	053554	1
35		TIE, Cable	06383	SSTIM	100753	A/R
6		TRANSFORMER, Power	52542	04555161	04555161	1
		ASSEMBLY, CHASSIS #053736				
5		SWITCH, Slide	79727	G-111-SPDT	102325	1
4		SPACER, Swage	05704	73-3	100510	11
6		STRIP, Terminal	7185	2003	102910	2
		ASSEMBLY, FRONT PANEL #053554				
1		PANEL, Decorative	52542	053552	053552	1
8		KNOB	07933	50-2Wd-1	100998	1
2		PANEL, Front, Finished	52542	053459	053459	1
		ASSEMBLY, Rivet, Front Panel	52542	05355491	05355491	1
9		MOULDING, Lens	52542	04559361	04559361	
4		HINGE			04559811	
3		BRACKET, Hinge			04559611	
11	J2	CONNECTOR, BNC	52542	MIL	101155	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION FINAL ASSEMBLY #053550 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
9	R1, R2	ASSEMBLY, Potentiometer	52542	053548	053548	1
		ASSEMBLY, LOGIC, A1 #05362101				
		ASSEMBLY, P. C. Logic	52542	053621	053621	1
	C1	CAPACITOR, Disc, 1 µF 20%, 25 V	56289	5C023105X0250B3	100176	4
	C2	CAPACITOR, EL AX, 100 µF +75-10%, 25 V	56289	TE1211	100165	1
	C3	CAPACITOR, Disc, .01µF+80-20%, 100 V				
	C4	CAPACITOR, Dip Mica, 12 pF 5%, 500 V	72136	DM15CD120J0	100240	1
	C5	Same as C1				
	C6	CAPACITOR, EL AX, 200 µF +75-10%, 15 V	56289	TE1164	100196	1
	C7	CAPACITOR, Tant, 47 µF 10%, 20 V	56289	150D476X9020R2	100186	1
	C8	Same as C3				
	C9	CAPACITOR, Disc, .05 µF +80-20%, 50 V	56289	TGS50	100134	12
	C10	Same as C3				
	C11	CAPACITOR, Tant, 39 µF 10%, 10 V	56289	150D396X9010B2	100183	2
	C12	Same as C1				
	C13	CAPACITOR, Disc, .1 µF 20%, 50 V	56289	5C023104X0500B3	100178	1
	C14	Same as C11				
	C15	Same as C9				
	C16	CAPACITOR, Dip Mica, 100 pF 5%, 500 V	72136	DM15FD101J0	100173	2
	C17	Same as C3				
	C18	Same as C3				
	C19	Same as C3				
	C20	Same as C16				
	C21	NOT USED				
	C22	CAPACITOR, Disc, 1000 pF 20%, 1 kV	91418	Type B	100076	3
	C23	CAPACITOR, Tant, 4.7 µF 10%, 10 V	56289	150D475X9010A2	100205	2
	C24	Same as C9				
	C25	Same as C23				
	C26	Same as C9				
	C27	Same as C9				
	C28	Same as C22				
	C29	Same as C22				
	C30	CAPACITOR, Disc, 5000 pF +60-40%, 150 V	71590	DDM502	100058	1
	C31	Same as C1				
	C32	Same as C9				
	C33	Same as C9				
	C34	Same as C9				
	C35	Same as C9				
	C36	Same as C9				
	C37	Same as C9				
	C38	Same as C9				
	CR1	DIODE, Signal, 20 V	03508	1N4829	100443	1
	CR2	DIODE, Signal, 50 V	03508	1N4151	100385	5
	CR3	Same as CR2				
	CR4	Same as CR2				
	CR5	Same as CR2				
	CR6	Same as CR2				
	CR7	Same as CR2				

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY #053550 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	L1	INDUCTOR, Fixed 100 µH	72259	WEE-100	101306	1
	Q1	TRANSISTOR, N-Channel, Dual Gate	04713	MFE121	101413	1
	Q2	TRANSISTOR, Silicon, NPN	07263	2N3646	101369	5
	Q3	Same as Q2				
	Q4	Same as Q2				
	Q5	TRANSISTOR, Silicon, PNP	04713	2N3906	101378	1
	Q6	TRANSISTOR, Silicon, NPN	04713	2N3904	101377	1
	Q7	Same as Q2				
	Q8	Same as Q2				
	R1	RESISTOR, Comp, 1 M 5%, 1/4 W	01121	CB1055	101605	2
	R2	RESISTOR, Comp, 270 Ω 5%, 1/4 W	01121	DB2715	101542	1
	R3	RESISTOR, Comp, 3.3 k 5%, 1/4 W				
	R4	RESISTOR, Comp, 2.7 k 5%, 1/4 W	01121	CB2725	101599	1
	R5	RESISTOR, Comp, 12 k 5%, 1/4 W	01121	CB1235	101565	3
	R6	RESISTOR, Comp, 5.6 k 5%, 1/4 W	01121	CB5625	101584	3
	R7	RESISTOR, Comp, 330 k 5%, 1/4 W	01121	CB3345	101658	1
	R8	RESISTOR, Potentiometer, Ceramic, 4-turn, 100 k 20%, 1/2 W, end adjust	80294	3339W-1-104	100027	1
	R9	Same as R1				
	R10	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	3
	R11	RESISTOR, Comp, 200 Ω 5%, 1/4 W	01121	CB2015	101555	1
	R12	RESISTOR, Comp, 100 k 5%, 1/4 W	01121	CB1045	101558	2
	R13	RESISTOR, Comp, 33 k 5%, 1/4 W	01121	CB3335	101576	1
	R14	Same as R5				
	R15	Same as R5				
	R16	RESISTOR, Comp, 620 Ω 5%, 1/4 W	01121	CB6215	101688	1
	R17	RESISTOR, Comp, 510 Ω 5%, 1/4 W	01121	CB5115	101616	1
	R18	Same as R12				
	R19	RESISTOR, Comp, 618 k, 5%, 1/4 W	01121	CB6825	101544	1
	R20	RESISTOR, Comp, 2.2 k 5%, 1/4 W	01121	CB2225	101562	1
	R21	RESISTOR, Comp, 470 Ω 5%, 1/4 W	01121	CB4715	101625	2
	R22	RESISTOR, Comp, 56 Ω 5%, 1/4 W	01121	CB5605	101735	1
	R23	Same as R21				
	R24	Same as R10				
	R25	Same as R10				
	R26	RESISTOR, Comp, 4.7 k 5%, 1/4 W	01121	CB4725	101598	6
	R27	Same as R6				
	R28	Same as R26				
	R29	Same as R26				
	R30	RESISTOR, Comp, 47 k 5%, 1/4 W	01121	CB4735	101574	4
	R31	Same as R30				
	R32	Same as R6				
	R33	Same as R30				
	R34	Same as R26				
	R35	Same as R26				
	R36	Same as R26				
	R37	Same as R30				
	R38	RESISTOR, Comp, 1.2 k 5%, 1/4 W	01121	CB1225	101581	2
	R39	Same as R38				
	S1	ASSEMBLY, Switch, Pushbutton M6202	52542	04559161	04559161	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY #053550 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	U1	INTEGRATED CIRCUIT, Quad 2-input NOR Gates, TTL	04713	MC3002P	025739	3
	U2	INTEGRATED CIRCUIT, Dec/Store Tri-State TTL	27014	DM85L52N	045212	5
	U3	Same as U2				
	U4	Same as U2				
	U5	Same as U2				
	U6	Same as U2				
	U7	Option 16				
	U8	Option 16				
	U9	INTEGRATED CIRCUIT, 4 x 2 in NAND SCHMITT	01295	SN74132N	045270	1
	U10	Same as U1				
	U11	INTEGRATED CIRCUIT, Quad 2-input OR Gates, TTL	04713	MC3003P	025767	2
	U12	INTEGRATED CIRCUIT, Quad 2-input AND Gates, TTL	04713	MC3001P	025740	3
	U13	INTEGRATED CIRCUIT, BCD Decimal Decoder, TTL	01295	SN7442N	025749	2
	U14	INTEGRATED CIRCUIT, Binary Counter, Parallel Set, TTL	18324	N8281A	025727	2
	U15	INTEGRATED CIRCUIT, Timer, Wide Range, LIN	13324	NE555V	045208	1
	U16	INTEGRATED CIRCUIT, Dual D flip-flop TTL	01295	SN7474N	025241	4
	U17	Same as U1				
	U18	Same as U16				
	U19	INTEGRATED CIRCUIT, Dual One-Shot Multivibrator, TTL	01295	SN74123N	045209	2
	U20	INTEGRATED CIRCUIT, Quad 2-input NAND Gates, TTL	01295	SN7400N	019705	2
	U21	Same as U16				
	U22	INTEGRATED CIRCUIT, Hex Inverter, TTL	01295	SN7404N	025779	1
	U23	INTEGRATED CIRCUIT, Quad 2-input NAND Open, TTL	01295	SN7426N	045252	2
	U24	Same as U13				
	U25	INTEGRATED CIRCUIT, Quad Latch, TTL	01295	SN7475N	019710	1
	U26	Same as U23				
	U27	Same as U19				
	U28	Same as U12				
	U29	INTEGRATED CIRCUIT, Counter Timebase, Programmable, MOS	50088	MK5009	045214	1
	U30	Same as U14				
	U31	INTEGRATED CIRCUIT, Quad 2-input Exclusive OR Gate, TTL	04713	MC3021P	025789	1
	U32	Same as U16				
	U33	Same as U12				
	U34	Same as U20				
	U35	Same as U11				
	VR1	DIODE, Zener, 6.5 V 10%	13715	FZ902	102736	1
		SPACER, Right Angle	88245	1590 B	100489	4
		SOCKET, Integrated Circuit, 8 terminal strip	27264	1938-4B-8	102432	4
		SOCKET, Integrated Circuit, 8 hole insulating nest	27264	06-05-3081	03946603	4

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY #053550 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		SHIELD, Can Modification	52542	053097	053097	1
		SHIELD, Can	98376	Z26-54-9	100022	1
		SPACER, Swage	06540	9537A-B-0440-3A	100021	2
		ASSEMBLY, POWER SUPPLY, A2 #05367101				
		POWER SUPPLY, P. C. Board	52542	053671	053671	1
	C1A	CAPACITOR, Disc, 2x.005 µF, 1.4 kV	56289	125L2D50/29C147	102615	2
	C1B	Same as C1A				
	C2A	Same as C1A				
	C2B	Same as C1A				
	C3	CAPACITOR, El Ax, 2000-4400 µF, 15 V	99392	33C15CL252	100247	1
	C4	CAPACITOR, El Ax, 20 µF, 350 V	56289	39D206F350FL4	100226	1
	C5	CAPACITOR, Dip Mica, 100 pF, 500 V	72136	DM15FD101J0	10017301	1
C6	C6	CAPACITOR, El Ax, 100 µF, 25 V	56289	TE1211	100165	1
	CR1	DIODE, Rectifier, 600 V	04713	1N4005	100413	12
	CR2	Same as CR1				
	CR3	Same as CR1				
	CR4	Same as CR1				
	CR5	Same as CR1				
	CR6	Same as CR1				
	CR7	Same as CR1				
	CR8	Same as CR1				
	CR9	Same as CR1				
	CR10	Same as CR1				
	CR11	Same as CR1				
	CR12	Same as CR1				
	L1	CHOKE, 100 µH 20%, .22 Ω	76493	5250	10132801	2
	L2	Same as L1				
	Q1	TRANSISTOR, Silicon, NPN, 300 V	04713	MPS-A42	101421	1
	R1	RESISTOR, Comp, 100 k 5%, 1/4 W	01121	CB1045	101558	
	R2	RESISTOR, Comp, 560 k 5%, 1/4 W	01121	CB5645	101687	1
	R3	RESISTOR, Comp, 3.0 k 5%, 1/4 W	01121	CB3025	101548	2
	R4	Same as R3				
	R5	RESISTOR, Comp, 2.0 k 5%, 1/4 W	01121	CB2025	101553	
	R6	RESISTOR, Comp, 3.6 k 5%, 1/4 W	01121	CB3625	101600	1
	R7	RESISTOR, Comp, 7.5 k 5%, 1/4 W	01121	CB7525	101596	1
	U1	INTEGRATED CIRCUIT, Voltage Regulator 2-37 V .15 A	27014	LM723CN	025761	1
	VR1	DIODE, Zener, 180 V	04713	1N991B	100461	1
	F1	FUSE, 250 V	75915	312.500	100595	1
		FUSE BLOCK for 3 AG Lug Terminals	75915	357001	102440	1
	C1 A,B	CAPACITOR, Disc, 5000 pF 20%, 500 V	91418	SM250	100077	4
	C2 A,B	(Alternate substitute for C1, C2 when #125L2D50/29C147 is not available)				
		ASSEMBLY, READOUT, A3 #04558643				
		P. C. BOARD	52542	04558611	04558611	1
	CR1	DIODE, LED	28480	HPA 5082-4480	100460	3

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY #053550 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART UMBER	(5) SD STOCK NO.	(6) T/Q
	CR2	Same as CR1				
	CR3	Same as CR1				
	Q1	TRANSISTOR, Silicon, NPN	04713	MPS-A42	101421	5
	Q2	TRANSISTOR, Silicon, NPN	07263	PN4889-18	101422	5
	Q3	Same as Q1				
	Q4	Same as Q2				
	Q5	Same as Q1				
	Q6	Same as Q2				
	Q7	Same as Q1				
	Q8	Same as Q2				
	Q9	Same as Q1				
	Q10	Same as Q2				
	R1	RESISTOR, Comp, 1 k 5%, 1/4 W	0112I	CB1025	101569	2
	R2	Same as R1				
	R3	RESISTOR, Comp, 2.2 k 5%, 1/4 W	01121	CB2225	101562	5
	R4	RESISTOR, Comp, 390 k 5%, 1/4 W	01121	CB3945	101787	5
	R5	RESISTOR, Comp, 4.7 k 5%, 1/4 W	01121	CB4725	101598	6
	R6	Same as R3				
	R7	Same as R4				
	R8	Same as R5				
	R9	Same as R3				
	R10	Same as R4				
	R11	Same as R5				
	R12	Same as R3				
	R13	Same as R4				
	R14	Same as R5				
	R15	Same as R3				
	R16	Same as R4				
	R17	Same as R5				
	R18	RESISTOR, Comp, 560 k 5%, 1/4 W	01121	CB5645	101687	2
	R19	RESISTOR, Comp, 1 M 5%, 1/4 W	01121	CB1055	101605	2
	R20	Same as R18				
	R21	Same as R19				
	R22	Same as R5				
	R23	RESISTOR, Comp, 270 Ω 5%, 1/4 W	01121	CB2715	101542	3
	R24	Same as R23				
	R25	Same as R23				
	R26	RESISTOR, Comp, 330 k 5%, 1/4 W	01121	CB3345	101658	8
	R27	Same as R26				
	R28	Same as R26				
	R29	Same as R26				
	R44	Same as R26				
	R45	Same as R26				
	R46	Same as R26				
	R47	Same as R26				
	U1	INTEGRATED CIRCUIT, Decoder Driver, TTL	01295	SN7414IN	025730	1
	U2	INTEGRATED CIRCUIT, BCD 7 segment, Dec/Driver, TTL	52542	DD700	045203	1
	V1	DISPLAY, 7 segment	52542	SP-333	102401	1
	V2	DISPLAY, 7 segment	52542	SP-332	102400	1

EQUIPMENT/ASSEMBLY DESIGNATION: FINAL ASSEMBLY #053550 (Cont'd)

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	XV1	SOCKET Display	52542	CS-333	102443	1
	XV2	SOCKET Display	52542	CS-332	102444	1
		SPACER	06540	9208N-115	101077	3
		ASSEMBLY, OSCILLATOR, A4 #04560441				
		P. C. BOARD	52542	04560411	04560411	1
	C1	CAPACITOR, Disc, .01 µF, +80-20%, 100 V	91418	TA110	100103	2
	C2	Same as C1				
	C3	CAPACITOR, Disc, .1 µF +80-20%, 10 V	71590	UK10-104	100120	1
	C4	CAPACITOR, Dip Mica, 10 pF 5%, 500 V	72136	DM15CD100J0	10025301	1
	C5	CAPACITOR, Dip Mica, 33 pF 5%, 500 V	72136	DM15ED330J0	10017501	1
	C6	CAPACITOR, Dip Mica, 100 pF 5%, 500 V	72136	DM15FD101J0	10017301	1
	C7	CAPACITOR, Dip Mica, 220 pF 5%, 500 V	72136	DM15FD221J0	10022001	1
	C8	CAPACITOR, Dip Mica, 150 pF 5%, 500 V	72136	DM15FD151J0	10021901	1
	C9	CAPACITOR, Dip Mica, 47 pF 5%, 500 V	72136	DM15ED470J0	10017101	
	C10	CAPACITOR, 9-35 pF, Right Angle mount	72982	538-006D9.0-35	100159	1
	CR1	DIODE, Signal, 50 V	03508	1N4151	100385	1
	Q1	TRANSISTOR, Silicon, NPN	07263	2N4275	102716	3
	Q2	Same as Q1				
	Q3	Same as Q1				
	Q4	TRANSISTOR, Silicon, PNP	07263	2N4258	102675	1
	U1	INTEGRATED CIRCUIT, Quad 2-input NAND Gates, DTL	01295	SN15846N	019716	1 1
	U2	INTEGRATED CIRCUIT, Decade Counter, TTL	01295	SN7490N	025732	1
	Y1	CRYSTAL	52542	039483	039483	1

CHAPTER 8
STANDARD OPTIONS

8.1 INTRODUCTION

This chapter contains the circuit descriptions, assembly/schematic drawings and replaceable parts lists for the standard options available with this instrument. The options are arranged in a numerical sequence in package format. The circuit description, followed by assembly/schematic drawings and the parts list. Where options are similar, the description, drawings, and parts lists are combined in a single package.

CIRCUIT DESCRIPTION
OPTION 06/OPTION 07
BATTERY PACK ASSEMBLY

1.1 DESCRIPTION

The battery pack assembly, Option 06, consists of an enclosure which houses both the battery pack and instrument. The battery pack consists of two 6 Vdc batteries, a charging circuit, and input/output receptacles for line or battery operation. A power inverter assembly, part of Option 07, is mounted in the instrument chassis for conversion of +6V battery power to voltages required in the instrument. Option 07 must be installed for use with Option 06.

Option 07 consists of a power inverter assembly, with banana plug inputs, for use with an external battery.

1.2 CIRCUIT DESCRIPTION

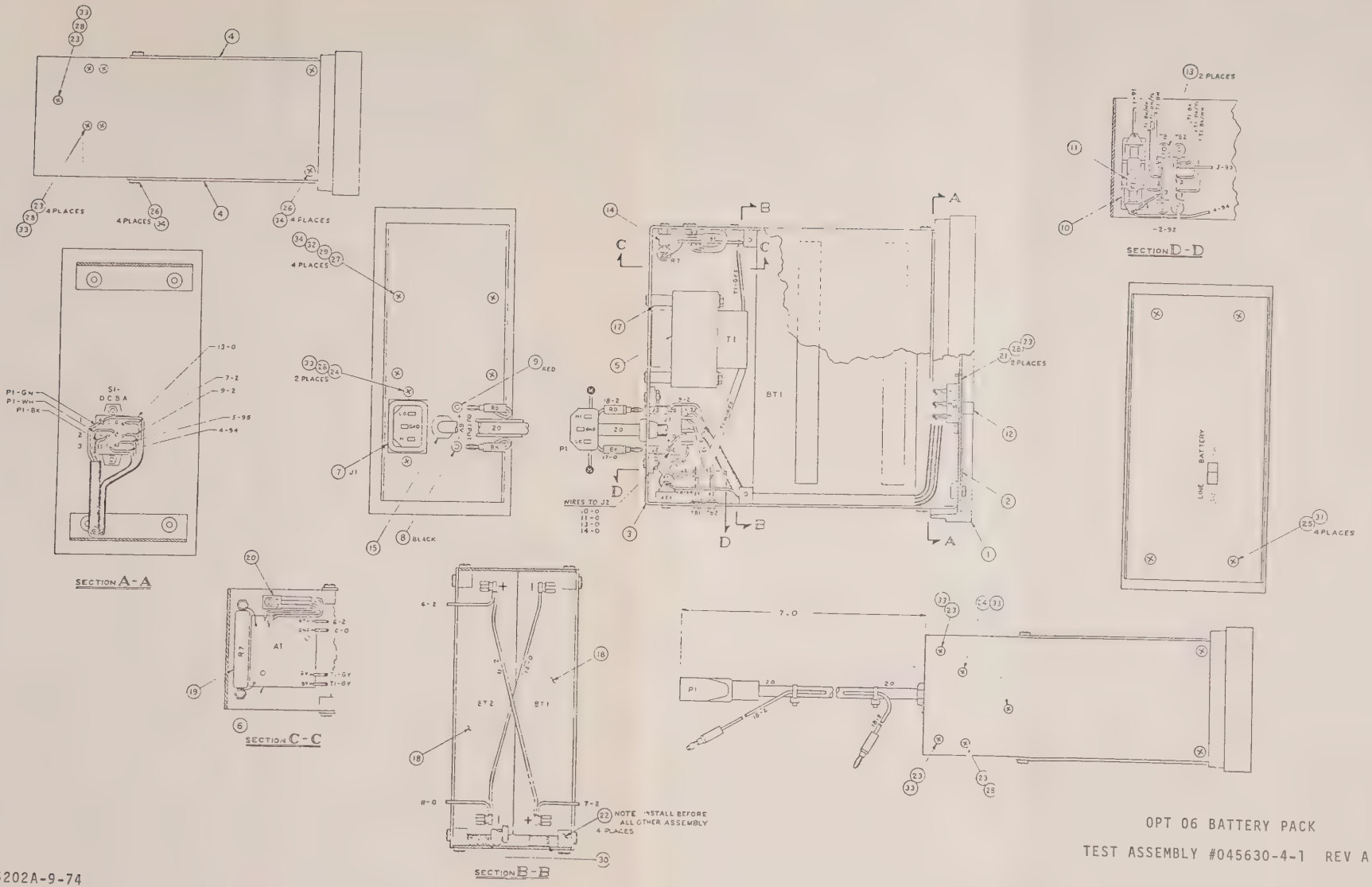
There are two separate assemblies used in Option 06, the battery charger assembly, schematic #045629-7-1, and the power inverter assembly, schematic #7-05367401. Each will be described separately.

1.2.1 Battery Charger Assembly, Schematic #045629-7-1

When operating on line voltage, the 9 Vac from T1 is routed through a bridge rectifier and applied to differential amplifier Q1/Q2. Bias on the base of Q1 is controlled by VR1 and potentiometer R6 controls bias on the base of Q2. The output of Q2 controls the output of pass transistor Q3.

1.2.2 Power Inverter Assembly, Schematic #7-05367401

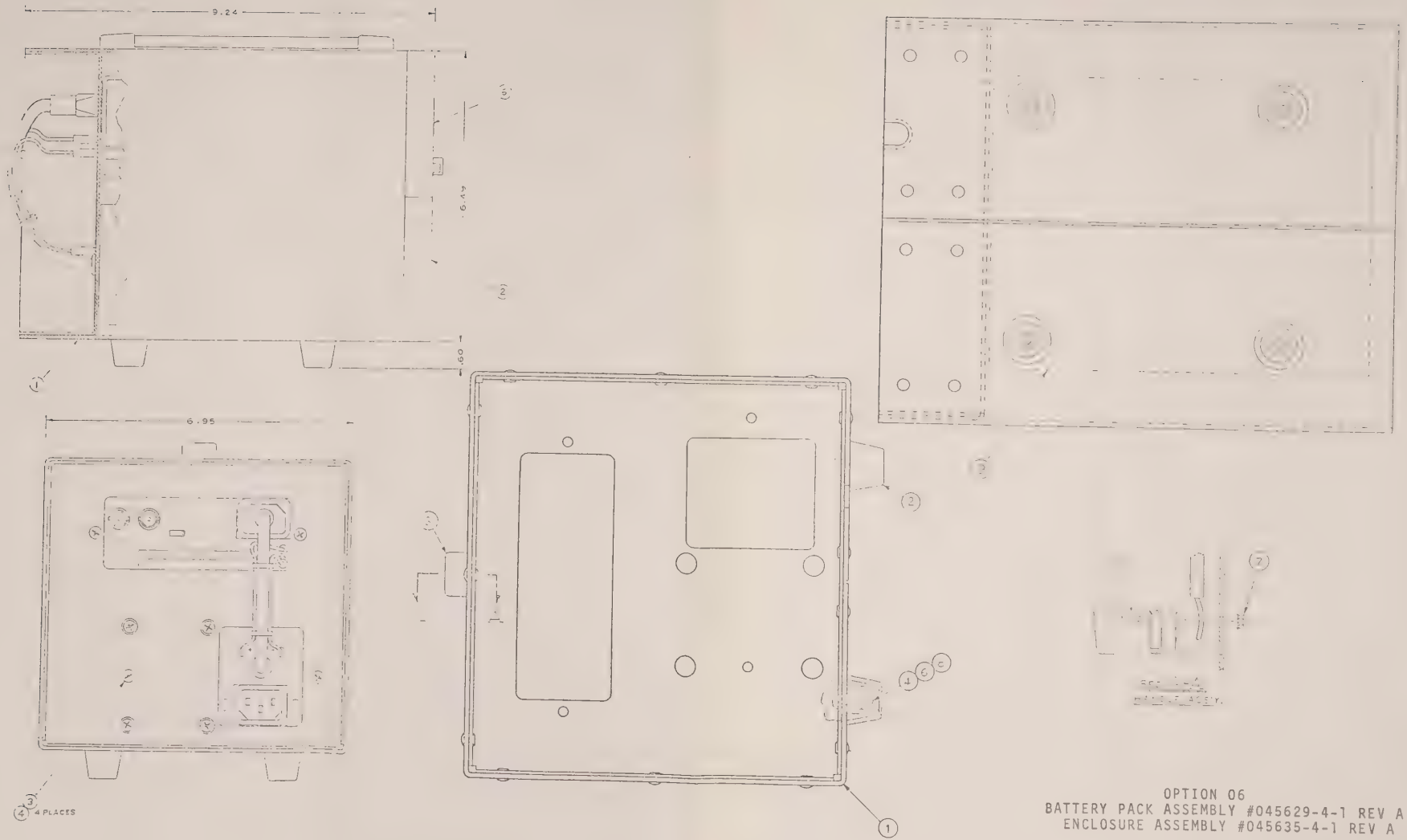
There are two independent +5 Vdc regulating circuits and, a power inverter, U2, which supplies +180 Vdc and -15 Vdc to the counter. One of the +5 Vdc regulators supplies voltage to the instrument, while the other supplies +5 Vdc to the power inverter. The +5 Vdc regulator to the counter consists of Q1, Q2, U1, VR1, and the associated circuitry. Operational amplifier, U1, controls the input to the base of Q2 and the output of Q2 is directly coupled to the base of Q1, the +5 Vdc pass transistor. Output of Q2 is adjusted with potentiometer R7. The +5 Vdc regulator Q2, Q4, J1, VR2, operates in a like manner. The output is coupled to voltage inverter, U2.



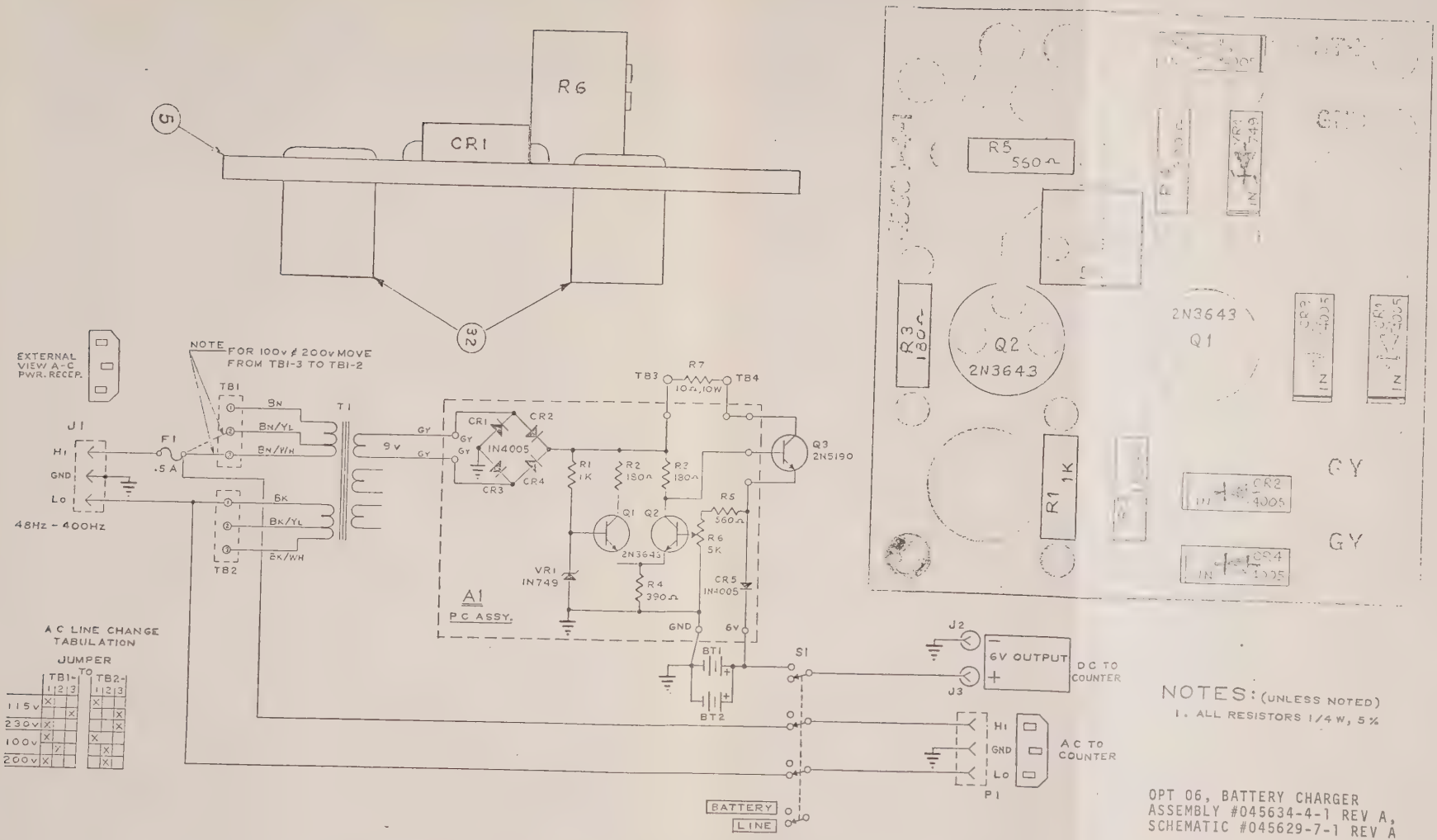
OPT 06 BATTERY PACK

TEST ASSEMBLY #045630-4-1 REV A

6202A-9-74



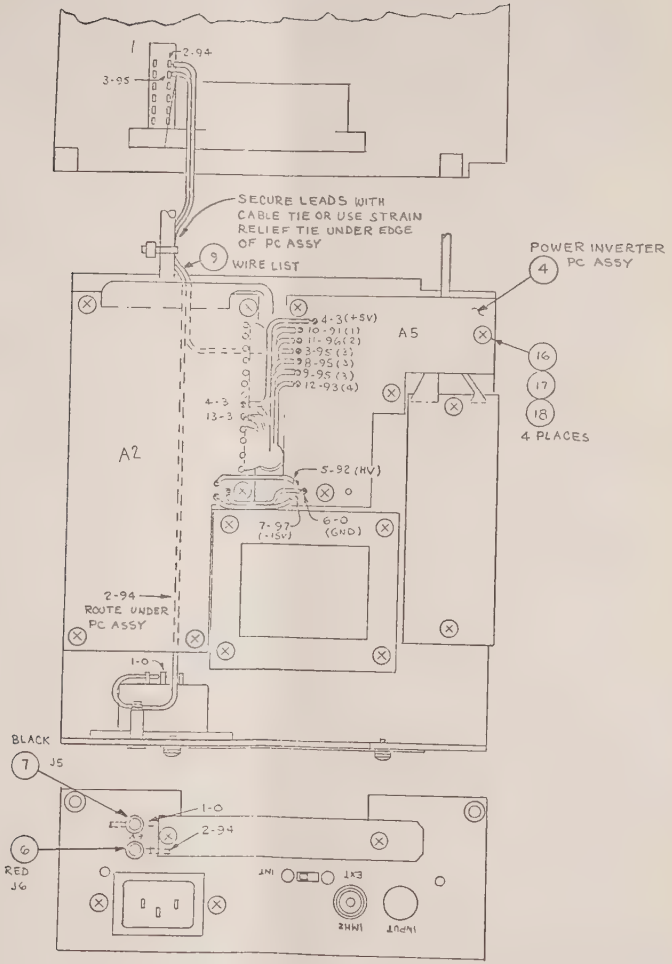
OPTION 06
BATTERY PACK ASSEMBLY #045629-4-1 REV A,
ENCLOSURE ASSEMBLY #045635-4-1 REV A

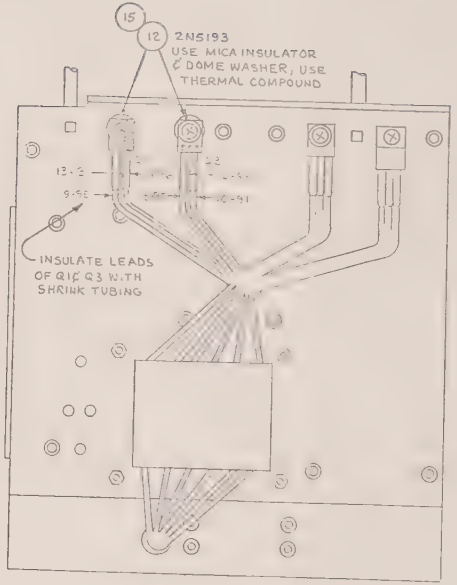


NOTES: (UNLESS NOTED)
1. ALL RESISTORS 1/4 W, 5%

OPT 06, BATTERY CHARGER
ASSEMBLY #045634-4-1 REV A,
SCHEMATIC #045629-7-1 REV A

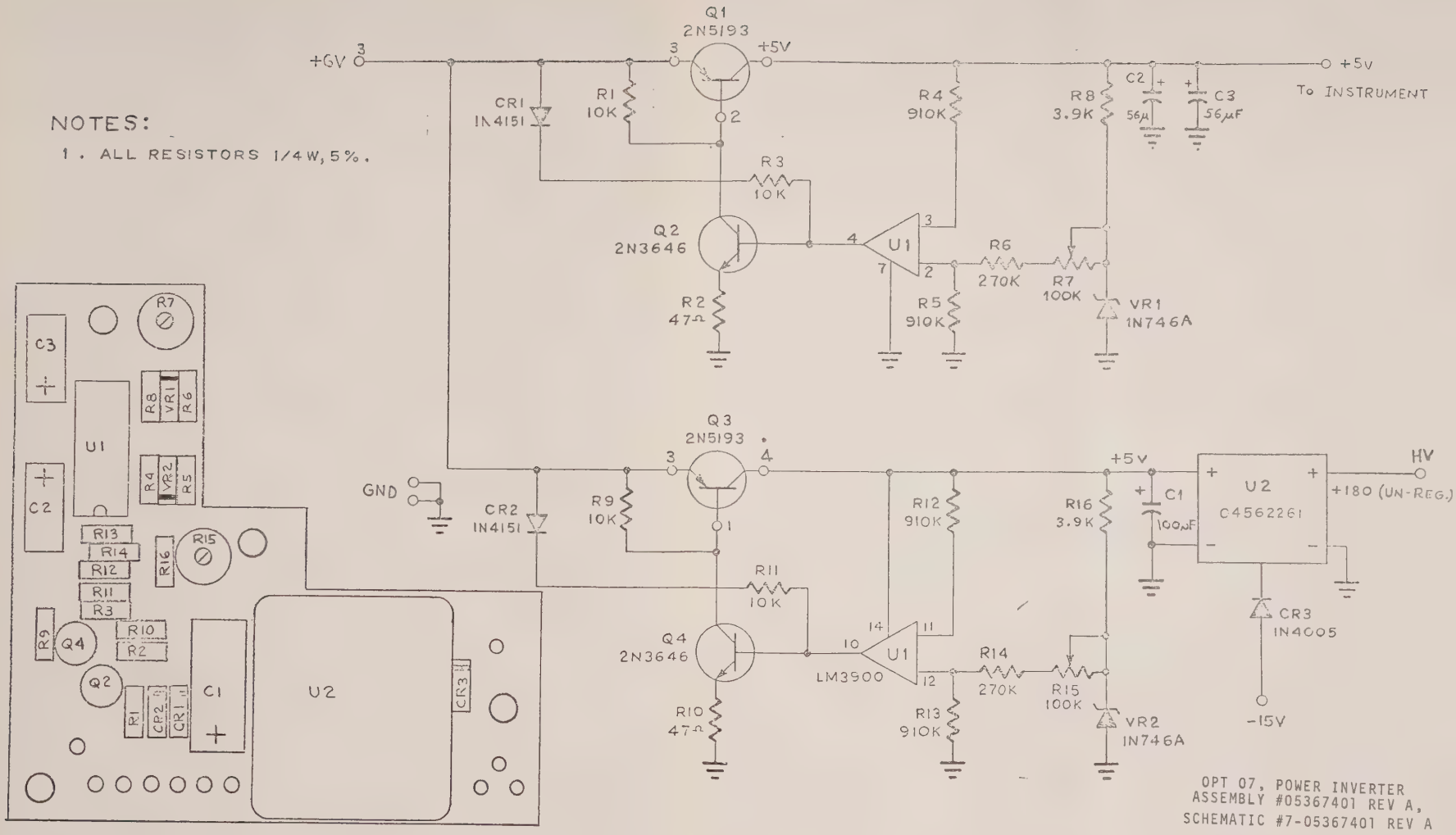
6202A-9-74





OPT 07 D C SUPPLY

ASSEMBLY #053769 REV A


NOTES:
1. ALL RESISTORS 1/4W, 5%.
+GV
GND
Q1
2N5193
+5V
CR1
IN4151
R1
10K
R4
910K
R8
3.9K
C2
56µ
C3
56µF
+5V
To INSTRUMENT
R3
10K
Q2
2N3646
U1
R6
270K
R7
100K
R2
47Ω
R5
910K
VR1
1N746A
Q3
2N5193
CR2
IN4151
R9
10K
R12
910K
R16
3.9K
C1
100µF
U2
C4562261
HV
+180 (UN-REG.)
R11
10K
Q4
2N3646
U1
LM3900
R14
270K
R15
100K
R10
47Ω
R13
910K
VR2
1N746A
CR3
IN4005
-15V
OPT 07, POWER INVERTER
ASSEMBLY #05367401 REV A,
SCHEMATIC #7-05367401 REV A
6202A-9-74

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 06/07, TEST ASSEMBLY #04563041

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
3		FRAME, Battery Pack	52542	04563111	04563111	1
4		ASSEMBLY, Battery Cover	52542	04563341	04533341	2
5	T1	TRANSFORMER, Power	52542	04555161	04555161	1
6	A1	ASSEMBLY, Token Standard	52542	04563441	04563441	1
7	J1	CONNECTOR, AC	82389	EAC-301	101288	1
8	J2	CONNECTOR, Jack, Black	74970	108-1103-001	101276	1
9	J3	CONNECTOR, Jack, Red	74970	108-1102-001	101275	1
10	XF1	FUSE BLOCK, 3 AG	75915	357001	102440	1
11	F1	FUSE, ¼ AG, 1/2 A	75915	312.500	100595	1
12	S1	SWITCH, Slide	82389	50212L	102373	1
13	TB1,TB2	TERMINAL, Strip, 3 lug	71785	2003	102910	1
14	TB3,TB4	TERMINAL, Insulator	92825	3A1-A1	100481	
15		STRAIN Relief	28520	SR-5P-4	103002	1
17		SPACER, 1/4 x 1/2 #6	83330	2102	100831	4
18	BT1,BT2	BATTERY, 6 V			10042	2
19	R7	RESISTOR, 10 Ω 5%, 10 W	56289	247E1005	102234	1
20	Q3	TRANSISTOR, Silicon, NPN	04713	2N5190	101394	1
22		SPACER, Right Angle	88245	1590 B	100489	4
		BATTERY PACK ASSEMBLY #04563441				
		BATTERY PACK	52542	04563411	04563411	1
	CR1	DIODE, Rectifier, 600 V	04713	IN4005	100413	5
	CR2	Same as CR1				
	CR3	Same as CR1				
	CR4	Same as CR1				
	CR5	Same as CR1				
	Q1	TRANSISTOR, Silicon, NPN	07263	2N3643	101358	2
	Q2	Same as Q1				
	R1	RESISTOR, Comp, 1 k 5%, 1/4 W	01121	CB1025	101569	1
	R2	RESISTOR, Comp, 180 Ω 5%, 1/4 W	01121	CB1815	101668	2
	R3	Same as R2				
	R4	RESISTOR, Comp, 390 Ω 5%, 1/4 W	01121	CB3915	101592	1
	R5	RESISTOR, Comp, 560 Ω 5%, 1/4 W	01121	CB5615	101583	1
	R6	INTEGRATED CIRCUIT, Potentiometer, Ceramic 5 k 10%, 1/2 W, Side Adjust	73138	62PAR5K	101845	1
	VR1	DIODE, Zener, 4.3 V	03877	1N749	100419	1
		SPACER, Swage	93330	4200	100003	2

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 06/07, POWER INVERTER ASSEMBLY # 05367401

(1) DESIGNATOR ITEM	REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
	C1	CAPACITOR, EL AX, 100 µF +75-10%, 25 V	56289	TE1211	100165	1
	C2	CAPACITOR, Tant, 56 µF, 10%, 6 V	56289	150D566X9006B2	100225	2
	C3	Same as C2				
	CR1	DIODE, Signal, 50 V	03508	1N4151	100385	2
	CR2	Same as CR1				
	CR3	DIODE, Rectifier, 600 V	04713	1N4005	100413	1
	Q1	TRANSISTOR, P/O, Final Assembly				
	Q2	TRANSISTOR, Silicon, NPN	07263	2N3646	101369	2
	Q3	P/O FINAL ASSEMBLY				
	R1	RESISTOR, Comp, 10 k 5%, 1/4 W	01121	CB1035	101570	4
	R2	RESISTOR, Comp, 47 Ω 5%, 1/4 W	01121	CB4705	101560	2
	R3	Same as R1				
	R4	RESISTOR, Comp, 910 k 5%, 1/4 W	01121	CB9145	101885	4
	R5	Same as R4				
	R6	RESISTOR, Comp, 270 k 5%, 1/4 W	01121	CB2745	101769	2
	R7	POTENTIOMETER, Ceramic, 4 turn, top adjust 100 k 20%, 1/2 W	80294	3339H-1-104	102298	2
	R8	RESISTOR, Comp, 3.9 k 5%, 1/4 W	0112.	CB3925	101601	2
	R9	Same as R1				
	R10	Same as R2				
	R11	Same as R1R				
	R12	Same as R4				
	R13	Same as R4				
	R14	Same as R6				
	R15	Same as R7				
	R16	Same as R8				
	U1	INTEGRATED CIRCUIT	27014	LM3900N	045213	1
	U2	INVERTER, Power, 5 V dc in, 180 V dc & 17 V out	52542	04562261	04562261	1
	VR1	DIODE, Zener, 3.3 V	03877	1N746A	100415	2
	VR2	Same as VR1				
		TERMINAL, Swage	88245	2000B	100482	11
		OPTION 07, FINAL ASSEMBLY #053769				
6		JACK, Red	74970	108-1102-001	101275	1
7		JACK, Black	74970	108-1103-001	101276	1
12	Q1	TRANSISTOR, Silicon, PNP	04713	2N5193	101405	2
	Q3	Same as Q1				
21		PLUG, Red	74970	108-1002-001	101278	1
22		PLUG, Black	74970	108-1003-001	101279	1

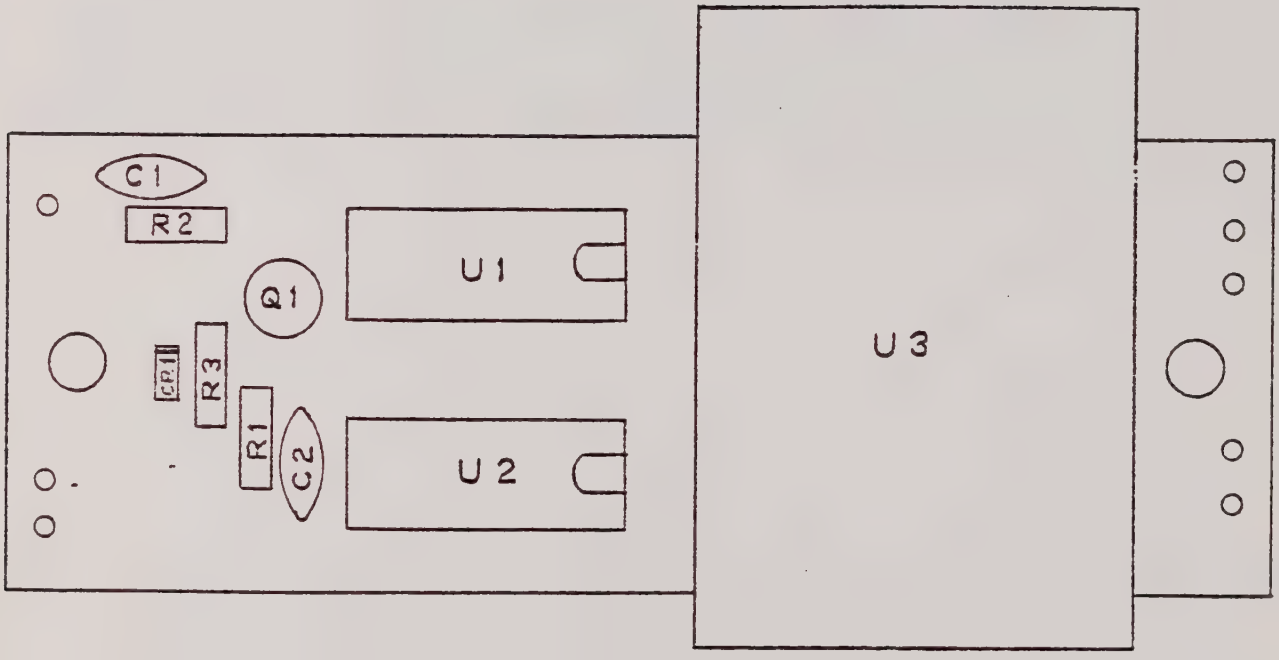
CIRCUIT DESCRIPTION
OPTION 08
TCXO OSCILLATOR ASSEMBLY

1.1 DESCRIPTION

The TCXO oscillator assembly improves time base temperature stability to ±1 part in 10^6 from 0 to 50° C. The assembly is a direct replacement for the standard oscillator.

1.2 CIRCUIT DESCRIPTION, TCXO OSCILLATOR ASSEMBLY, SCHEMATIC #45605-7-1

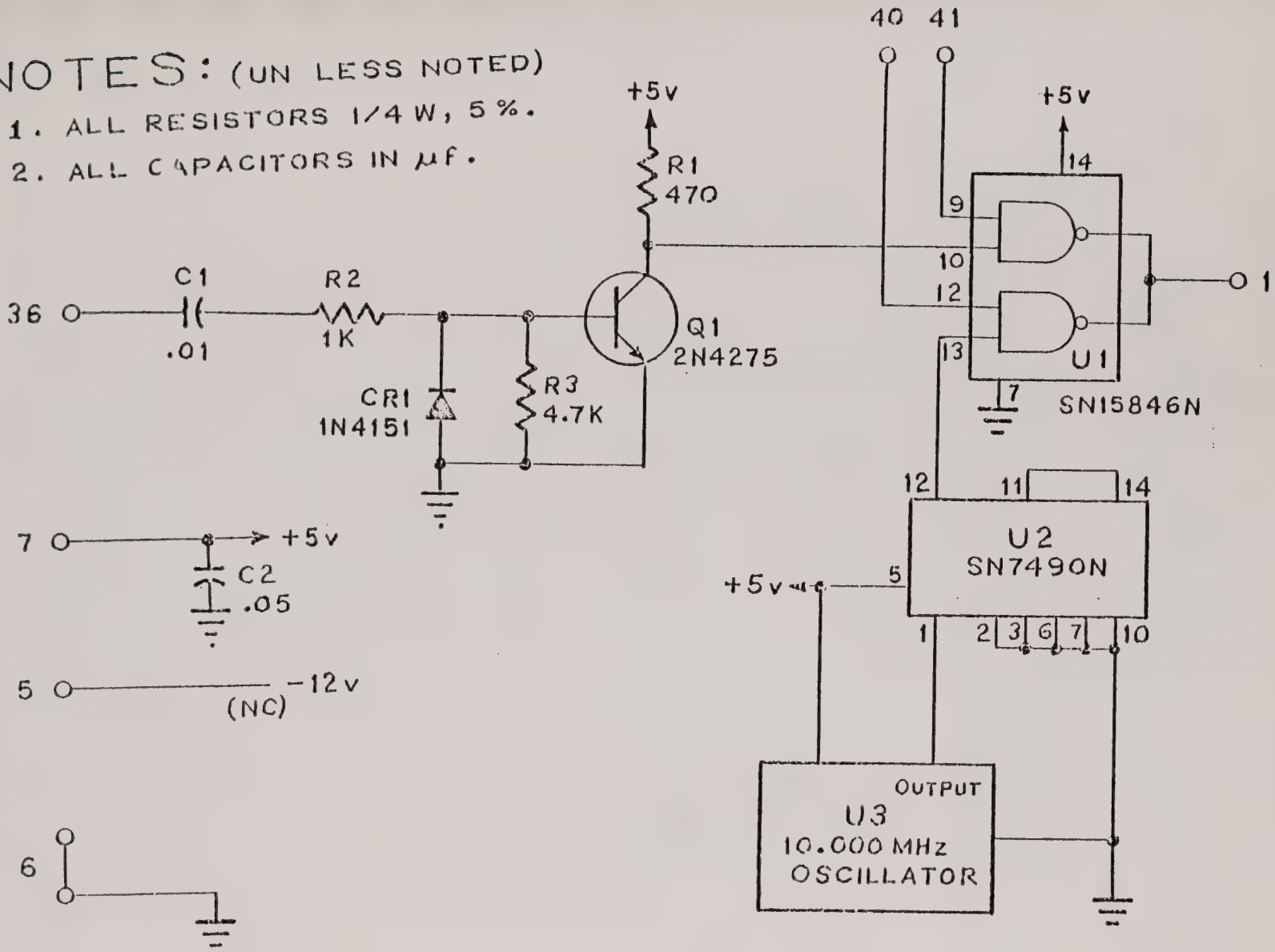
U3 is a temperature controlled 10 MHz oscillator with the output applied to a decade counter, U2. The output of U2 is 1 MHz through pin 13 of AND gate U1. When the INT/EXT switch on the rear panel is in the INT position AND gate U1-12, 13, 1, is enabled. When in the EXT position gate 9, 10, 1 is enabled and an external frequency source can be connected, through Q1, to furnish the time base for the instrument.



OPT 08, TCXO ASSEMBLY #045605-4-1 REV A

NOTES: (UN LESS NOTED)

1. ALL RESISTORS 1/4 W, 5%.
2. ALL CAPACITORS IN μf.



OPT 08, TCXO SCHEMATIC #045605-7-1 REV A

REPLACEABLE PARTS LIST

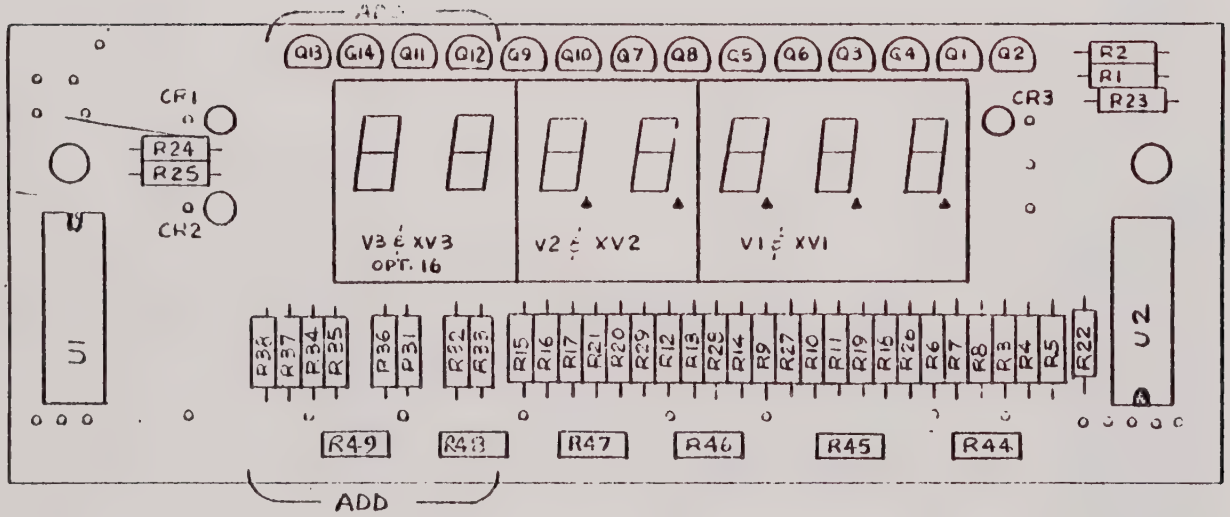
EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 08, (TCXO) OSCILLATOR #053836

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ADD				
		TCXO ASSEMBLY (A4)			053836	1
		DELETE				
		OSCILLATOR ASSEMBLY (A4)			04560541	1
		TCXO OSCILLATOR ASSEMBLY #4560571				
	C1	CAPACITOR, Disc, .01 µF +80-20%, 100 V	91418	TA110	100103	1
	C2	CAPACITOR, Disc, .05 µF +80-20%, 10 V	71590	UK10-503	100122	1
	CR1	DIODE, Signal, 50 V	03508	IN4151	100385	1
	Q1	TRANSISTOR, Silicon, NPN	07263	2N4275	102716	1
	R1	RESISTOR, 470 Ω 5%, 1/4 W	01121	CB4715	101625	1
	R2	RESISTOR, 1 k 5%, 1/4 W	01121	CB1025	101569	1
	R3	RESISTOR, 4.7 k 5%, 1/4 W	01121	CB4725	101598	1
	U1	INTEGRATED CIRCUIT, Quad 2-input, NAND Gates, DTL	01295	SN15846N	019716	1
	U2	INTEGRATED CIRCUIT, Decade Counter, TTL	01295	SN7490N	025732	1
	U3	OSCILLATOR, TCXO, 10 MHz	01537	K1087A-1T1B	100033	1

CIRCUIT DESCRIPTION
OPTION 16
SEVEN-DIGIT READOUT ASSEMBLY

1.1. DESCRIPTION

Option 16 provides two additional readout digits in the readout assembly. This requires the addition of two decade counters, two display tubes and the necessary circuitry for proper display. This option is shown installed in the Logic Assembly schematic #7-05362101, and Readout Assembly schematic #45586-73.



OPT 16, READOUT ASSEMBLY #045586-4-5 REV A

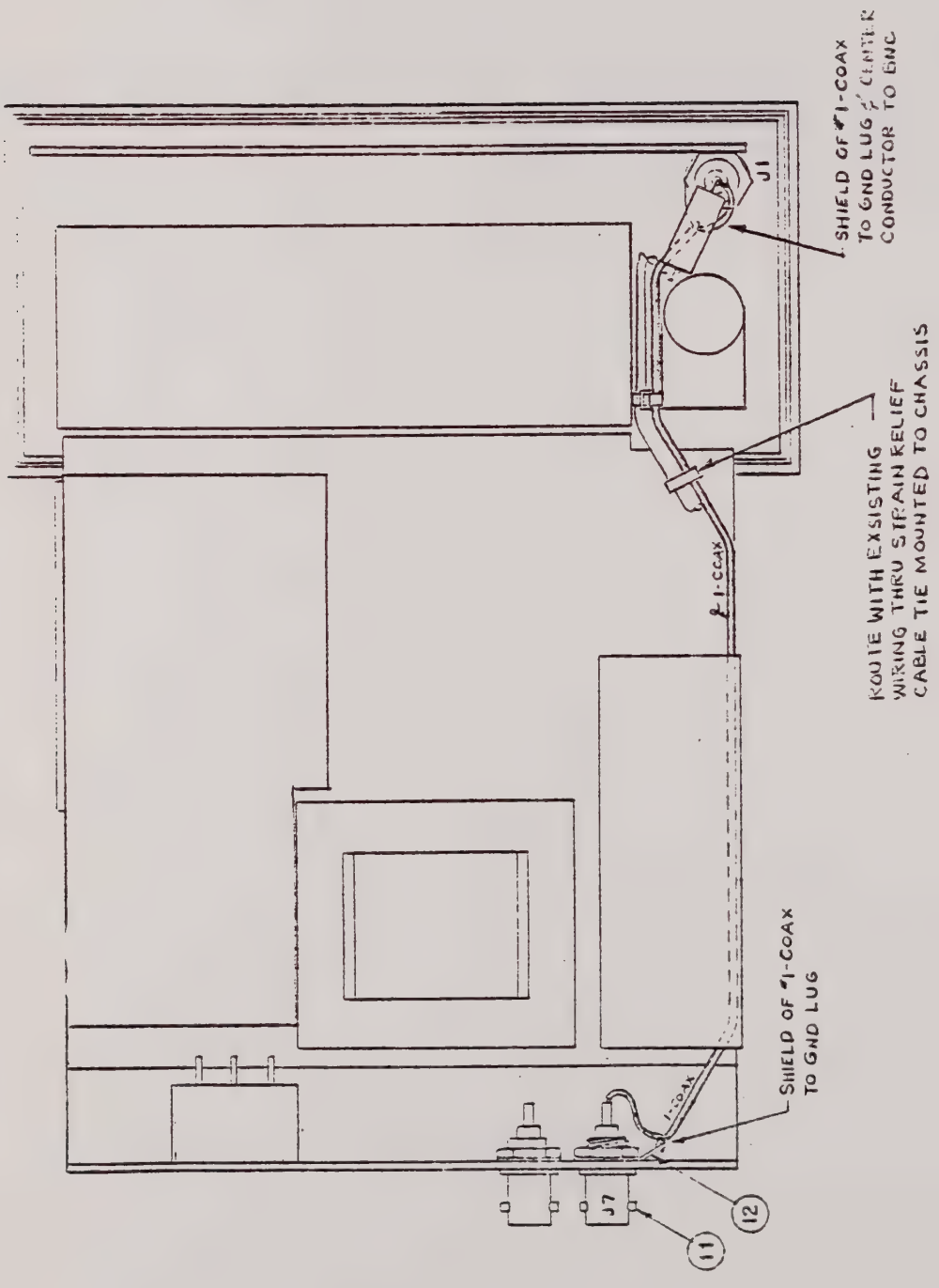
EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 16, 7 DIGIT READOUT #05362102

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY, 7 digit from 5 readout			04558645	1
	U7	INTEGRATED CIRCUIT, Dec/Store, tri-state, TTL	27014	DM85L52N	045212	2
	U8	Same as U7				
		DELETE				
		JUMPERS W1 & W2 from A1				
		ADD				
	Q11	TRANSISTOR, Silicon, NPN, 300 V	04713	MPS-A42	101421	2
	Q12	TRANSISTOR, Silicon, PNP	07263	PN4889-18	101422	2
	Q13	Same as Q11				
	Q14	Same as Q12				
	R31	RESISTOR, 2.2 k 5%, 1/4 W	01121	CB2225	101562	2
	R32	RESISTOR, 390 k 5%, 1/4 W	01121	CB3945	101787	2
	R33	RESISTOR, 4.7 k 5%, 1/4 W	01121	CB4725	101598	2
	R34	Same as R31				
	R35	Same as R32				
	R36	Same as R33				
	R37	RESISTOR, 560 k 5%, 1/4 W	01121	CB5645	101687	1
	R38	RESISTOR, 1 M 5%, 1/4 W	01121	CB1055	101605	1
	R48	RESISTOR, 330 k 5%, 1/4 W	01121	CB3345	101658	2
	R49	Same as R48				
	XV3	SOCKET, Display, 2 digit		CS-332	102444	1
	V3	DISPLAY, 2 digit		SP-332	102400	1

CIRCUIT DESCRIPTION
OPTION 31
REAR INPUT ASSEMBLY

1.1 DESCRIPTION

Option 31 provides for installation of an input BNC connector on the rear panel of the instrument. This input connector is paralleled with the input connector on the front panel.



OPT 31, REAR INPUT ASSEMBLY #053834 REV A

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 31, REAR INPUT #053834

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		DELETE				
6		BUTTON, Plug	83330	652	100840	1
		ADD				
11		RECEPTACLE, BNC	MIL	UG-1094/U	101155	1
12		LUG, Solder	83330	1497	100495	1

CIRCUIT DESCRIPTION
OPTION 35
BCD OUTPUT ASSEMBLY

1.1 DESCRIPTION

Option 35, BCD Conversion Cable, converts the group-serial parallel BCD outputs into a standard 8-4-2-1 parallel format, including decimal placement and legend units. P1 is a 50 pin Amphenol connector, 57-40500. Table OPT 35.1 lists the functions and pin connections for the BCD output.

1.2 CIRCUIT DESCRIPTION, BCD CONVERSION ASSEMBLY, SCHEMATIC #7-045603-7-

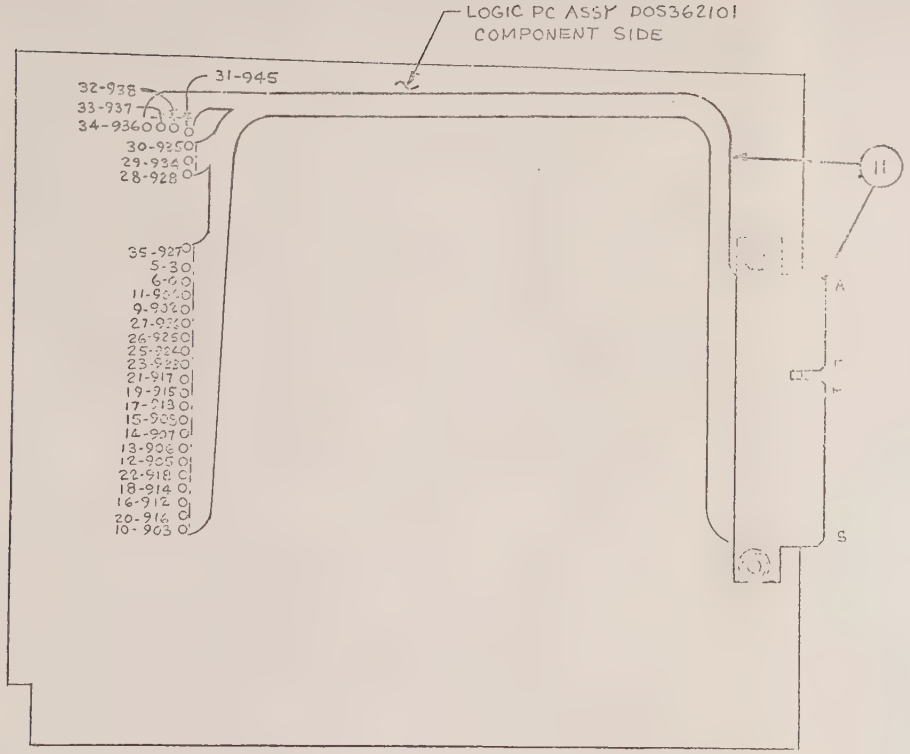
The interlaced multiplex signal from the Mother Board is applied, through AND gates, U1, to quad D flip-flop, U4 through U11, when the blanking gate is positive. If the blanking line is negative (low), the unit will transfer zeros into the registers. The strobe oscillator signal is applied through Q1 to one input of NOR gates U2 and U3. Decoded strobe pulses are applied to the other input. When both pulses are low, the strobe gates are high and the information is transferred from the group serial line to the respective quad D flip-flop, which is used as a storage register. Coded decimal point information is applied to U12 and U13 and stored. A +5 Vdc reference voltage and group reference are also supplied to the registers and the remote plug. External Gate, Reset, Gate Out, and Off Scale are also applied to the assembly and terminated on the board. These are available for remote programming should this be desired.

TABLE OPT 35.1 REAR PANEL BCD CONNECTIONS

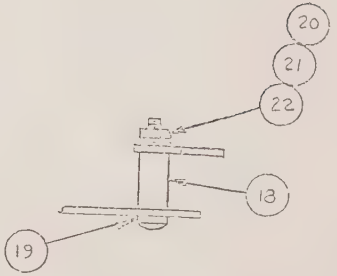
Function	BCD	Pin	Function	BCD	Pin
10^0	1	1	10^2	1	5
	2	2		2	6
	4	26		4	30
	8	27		8	31
10^1	1	3	10^3	1	7
	2	4		2	8
	4	28		4	32
	8	29		8	33

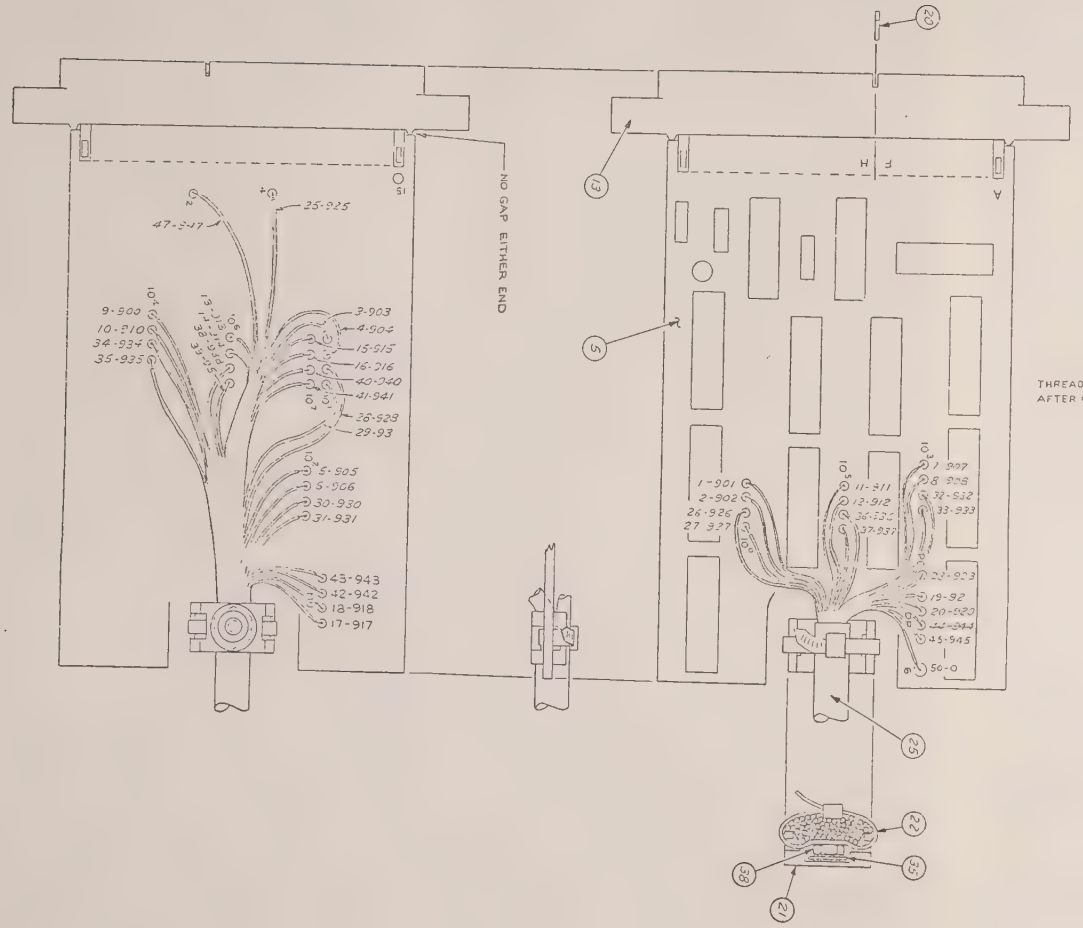
TABLE OPT 35.1 REAR PANEL BCD CONNECTIONS (Cont'd)

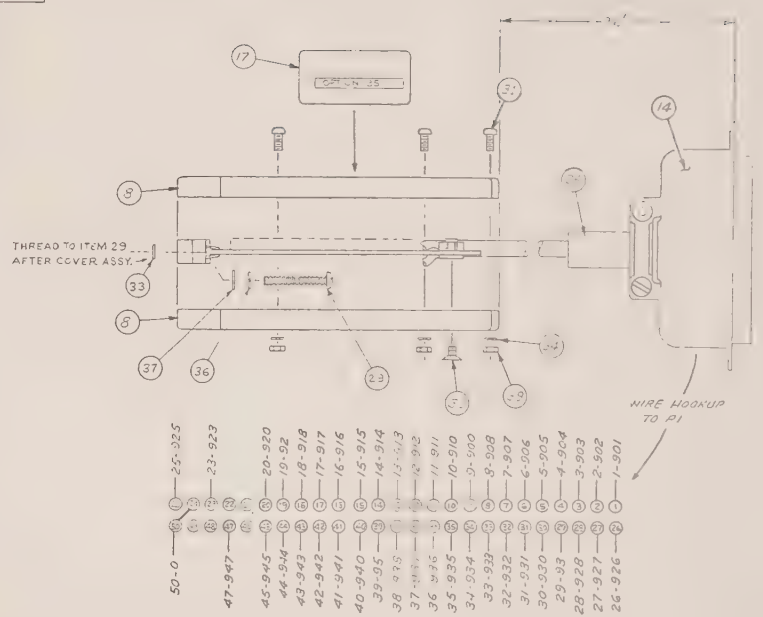
Function	BCD	Pin	Function	BCD	Pin
10^4	1	9	10^6	1	13
	2	10		2	14
	4	34		4	38
	8	35		8	39
10^5	1	11	10^7	1	15
	2	12		2	16
	4	36		4	40
	8	37		8	41
MU	1	17	DP	1	19
	2	18		2	20
	4	42		4	44
	8	43		8	45
+ Reference (+5V)		25			
- Reference (GND)		24,50			
Inhibit		47			
Print Command		23			



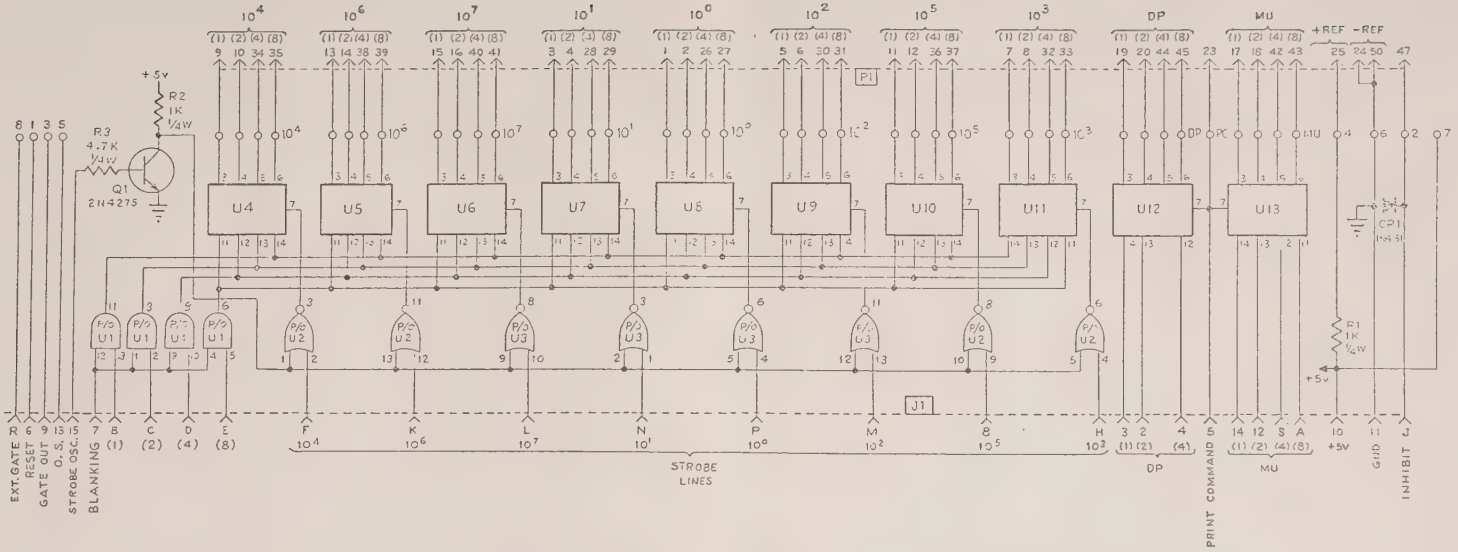
NOTE:
REMOVE COVER PLATE A053829
FROM REAR PANEL AND ADD
BCD CONVERSION ASSY C04S60341.





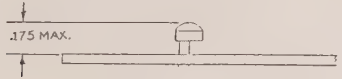


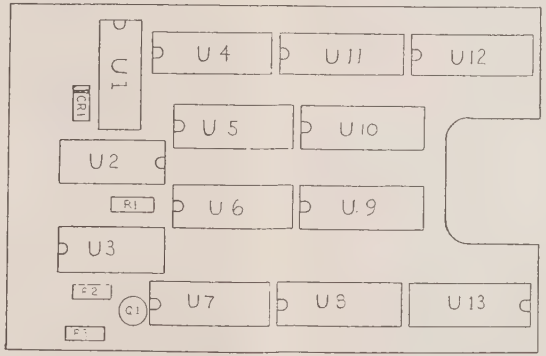
OPT 35 SERIAL TO PARALLEL BCD
CONVERSION #045787-4-1



	TYPE	+5v	GND
U1	MC1830P	14	7
U2	MC1810P	14	7
U3	MC1310P	14	7
U4	DM85L51N	16	12,15
U5			
U6			
U7			

	TYPE	-5	GND
U8	DM85L51N	16	12,15
U9			
U10			
U11			
U12			
U13			



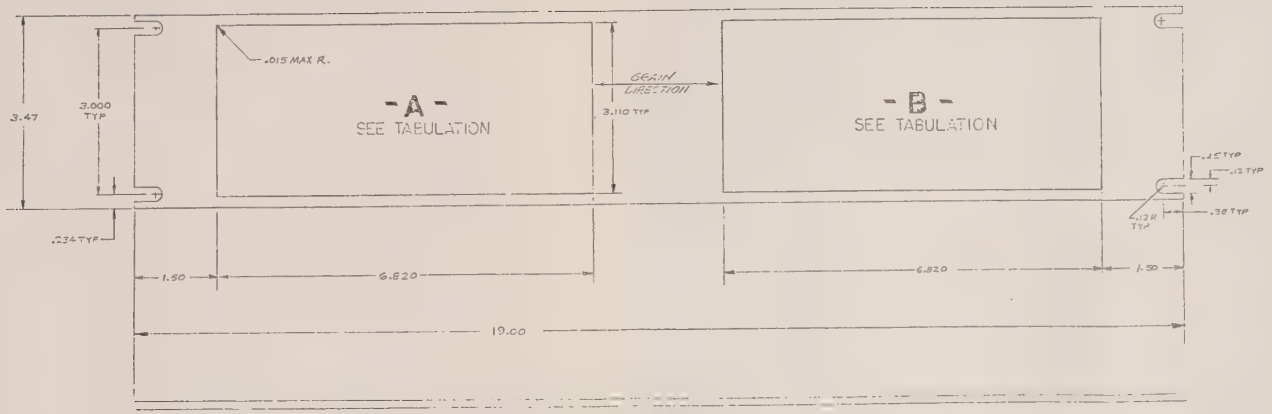


OPT 35, BCD CONVERSION
ASSEMBLY #045603-4-1 REV B
SCHEMATIC #045603-7-1 REV B

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: OPTION 35, BCD OUTPUT #053838

(1) DESIGNATOR ITEM	(1) DESIGNATOR REF	(2) COMPONENT NOMENCLATURE AND DESCRIPTION	(3) MFR'S CODE	(4) MANUFACTURER'S PART NUMBER	(5) SD STOCK NO.	(6) T/Q
		ASSEMBLY, BCD Conversion			04578741	1
		ASSEMBLY, BCD Conversion			04560341	1
		ASSEMBLY, BCD Cable			053839	1
		TAB			04559211	1
		SPACER, #6 x 1/2	83330	2102	100831	2
		DELETE				
		COVER PLATE			053829	1
		BCD CONVERSION ASSEMBLY #04560341				
		SPECIFICATION			04560311	1
	CR1	DIODE, Signal, 50 V	03508	1N4151	100385	1
	Q1	TRANSISTOR, Silicon, NPN	07263	2N4275	102716	1
	R1	RESISTOR, 1 k 5%, 1/4 W	01121	CB1025	101569	2
	R2	Same as R1				
	R3	RESISTOR, 4.7 k 5%, 1/4 W	01121	CB4725	101598	1
	U1	INTEGRATED CIRCUIT, Quad 2-input AND Gates, DTL	04713	MC1806P	025733	1
	U2	INTEGRATED CIRCUIT, Quad 2-input NOR Gates, DTL	04713	MC1810P	025735	2
	U3	Same as U2				
	U4	INTEGRATED CIRCUIT, Quad D Regulator Tri-State, TTL	27014	DM85L51N	045210	10
	U5	Same as U4				
	U6	Same as U4				
	U7	Same as U4				
	U8	Same as U4				
	U9	Same as U4				
	U10	Same as U4				
	U11	Same as U4				
	U12	Same as U4				
	U13	Same as U4				



TABULATION		
027342	BLANK	OMIT "A" & "B" CUTOUTS
027342-1	1-HOLE	OMIT "B" CUTOUT
027342-2	2-HOLE	AS SHOWN

RACK MOUNT PANEL #027342 REV B

CHAPTER 9
SUPPLEMENTAL INFORMATION

9.1 INTRODUCTION

This chapter contains revised or updated information reflecting changes in production requirements of this instrument. This information can include changes in assembly/schematic drawings, parts lists, operating instructions, calibration procedures, etc. Changes to parts lists will contain only the added parts, plus a list of deleted items. The supplemental pages for each assembly will be identified with the words SUPPLEMENTAL INFORMATION, followed by the nomenclature of the board. For example, if the Logic Assembly is to be changed, the package identification will read as follows:

SUPPLEMENTAL INFORMATION
A1, LOGIC ASSEMBLY
SCHEMATIC #7-05362101

Page identification for an October 19XX change will be:

5252-X-XX SUPPLEMENT; page numbering will be in numerical order.

MODEL 6202A
SUPPLEMENTAL INFORMATION
TEST ASSEMBLY #053558

1. CIRCUIT DESCRIPTION

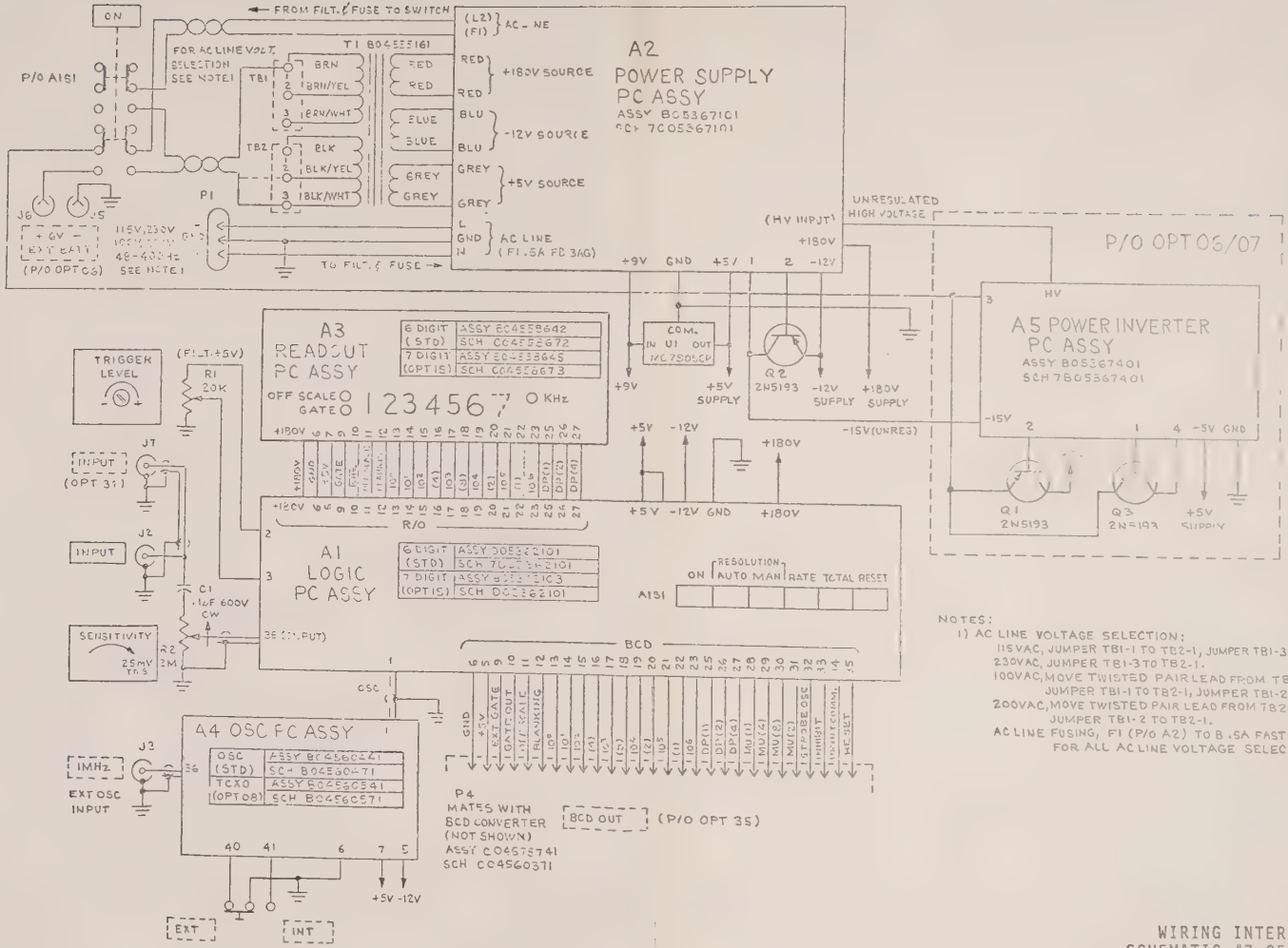
None

2. NEW DRAWINGS AND SCHEMATICS

Wiring Interconnect Schematic #7-053550 Rev C
Test Assembly #053558 Rev C

3. PARTS LIST ADDITIONS AND DELETIONS

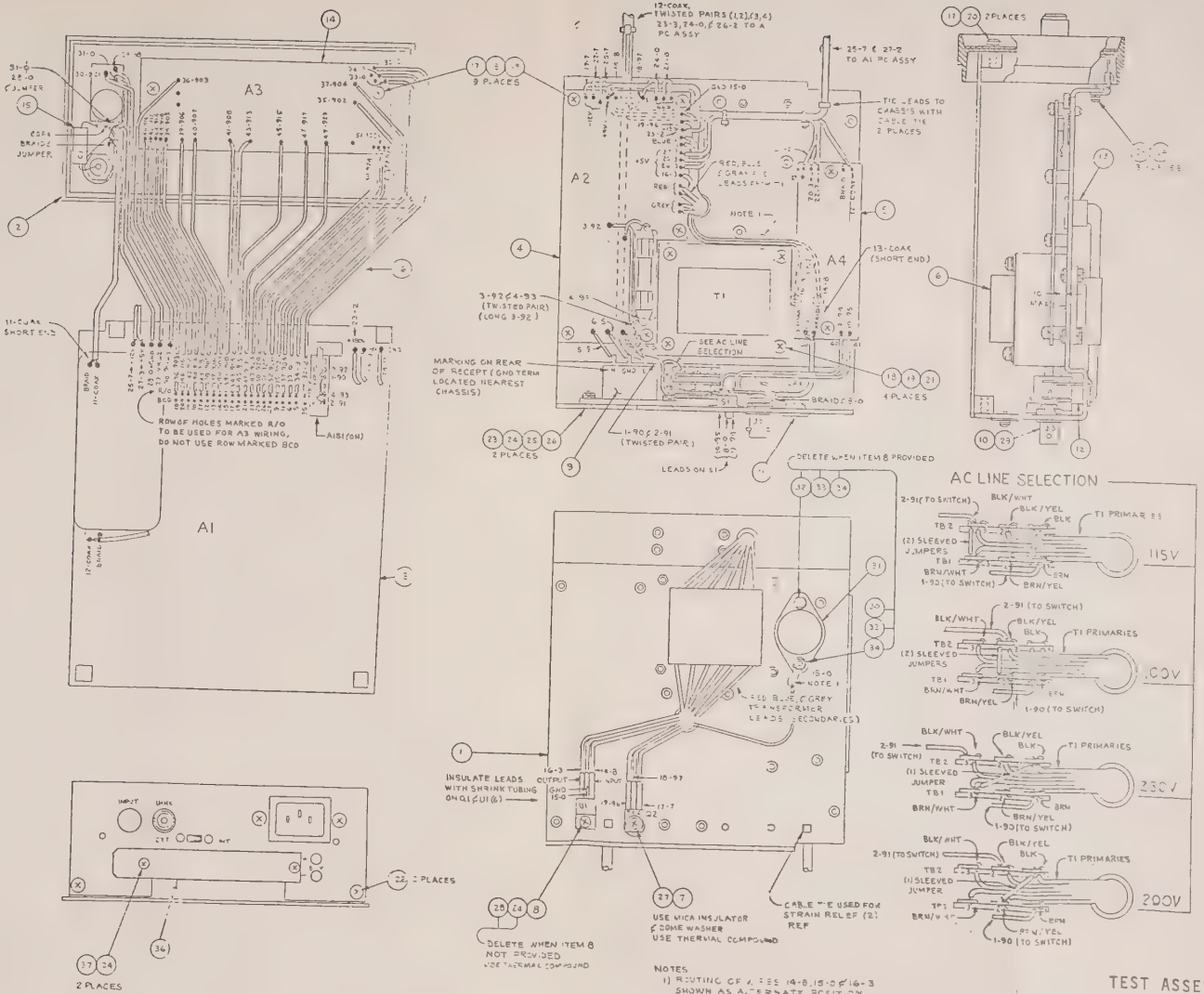
REF	DESCRIPTION	S-D PART NO.
	ADD	
A3	Assembly, Printed Circuit, Readout 6 digit	04558642
	DELETE	
A3	Assembly, Printed Circuit, Readout 5 digit	04558643



NOTES:

1) AC LINE VOLTAGE SELECTION:
   115VAC, JUMPER TB1-1 TO TB2-1, JUMPER TB1-3 TO TB2-3.
   230VAC, JUMPER TB1-3 TO TB2-1.
   100VAC, MOVE TWISTED PAIR LEAD FROM TB2-3 TO TB2-2
   JUMPER TB1-1 TO TB2-1, JUMPER TB1-2 TO TB2-2.
   200VAC, MOVE TWISTED PAIR LEAD FROM TB2-3 TO TB2-2,
   JUMPER TB1-2 TO TB2-1.
   AC LINE FUSING, F1 (P/O A2) TO 0.5A FAST BLO 3AG
   FOR ALL AC LINE VOLTAGE SELECTIONS.

WIRING INTERCONNECT
SCHEMATIC #7-053550 Rev C



TEST ASSEMBLY #053558 Rev C

MODEL 6202A
SUPPLEMENTAL INFORMATION
A1, LOGIC ASSEMBLY
SCHEMATIC #7-05362101

1. CIRCUIT DESCRIPTION

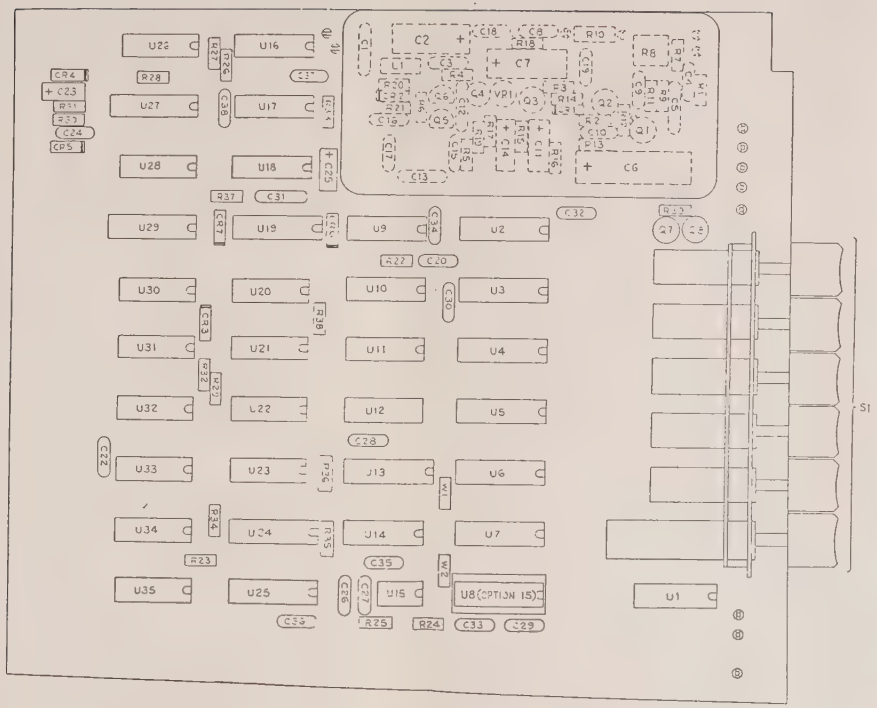
See Section 4.3.1, Page 4-2.

2. NEW DRAWINGS AND SCHEMATIC

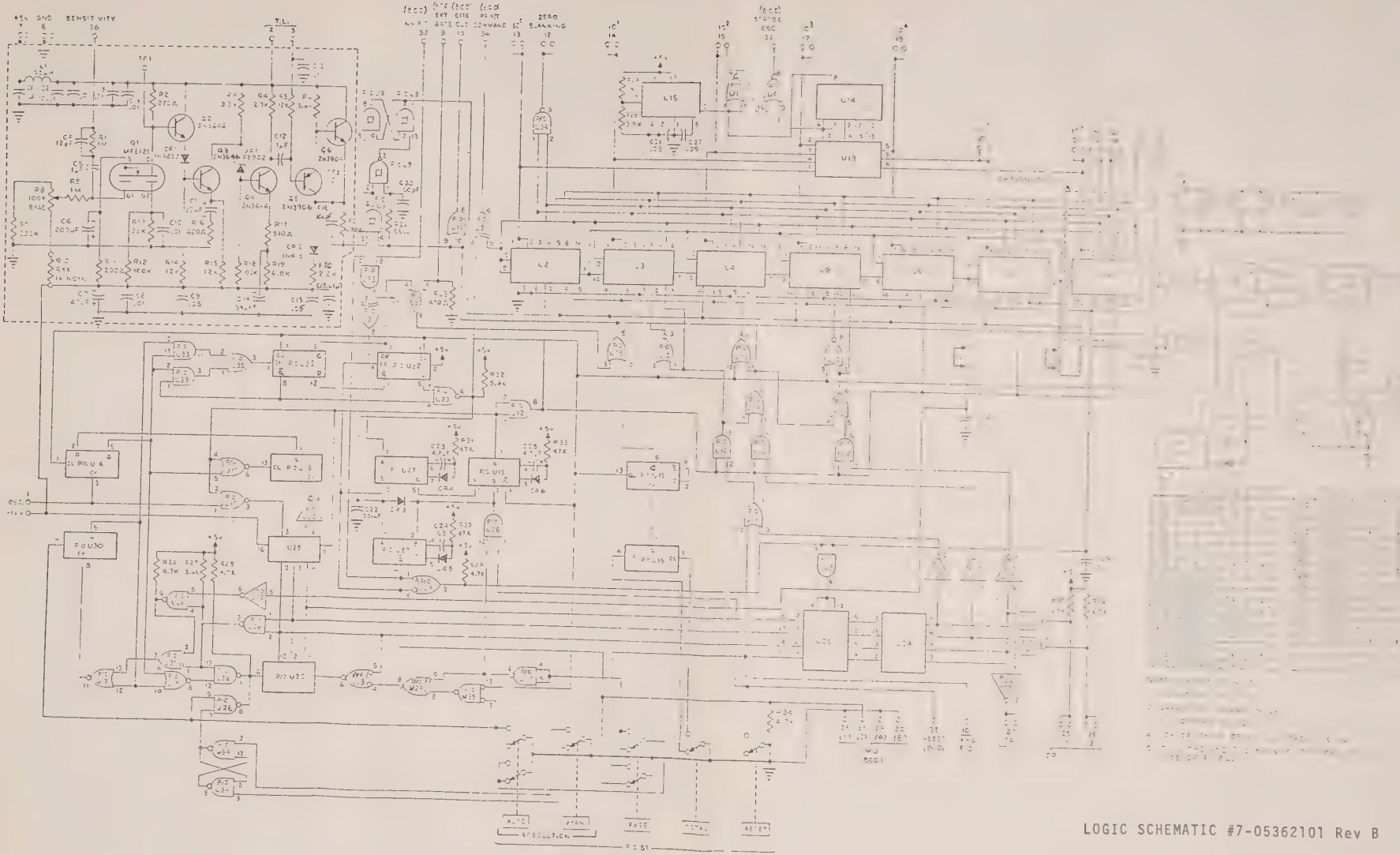
A1, Logic Assembly #05362101 Rev B
A1, Logic Schematic #7-05362101 Rev B

3. PARTS LIST ADDITIONS AND DELETIONS

REF	DESCRIPTION	S-D PART NO.
	ADD	
R25	Resistor, 3.9 k, 5%, 1/4 w	101601
	DELETE	
R25	Same as R10	
	CHANGE	
	Socket, Integrated Circuit, 8 terminal Strip from 4 to 2	
	Socket, Integrated Circuit, 8 hole insulating nest, from 4 to 2	



LOGIC ASSEMBLY #05362101 Rev B



LOGIC SCHEMATIC #7-05362101 Rev B

MODEL 6202A
SUPPLEMENTAL INFORMATION
A2, POWER SUPPLY
SCHEMATIC #7-05367101

1. CIRCUIT DESCRIPTION

See Section 4.3.2 Page 4-4

2. NEW DRAWINGS AND SCHEMATICS

Power Supply Assembly #05367101 Rev B
Power Supply Schematic #7-05367101 Rev C

3. PARTS LIST ADDITIONS AND DELETIONS

None

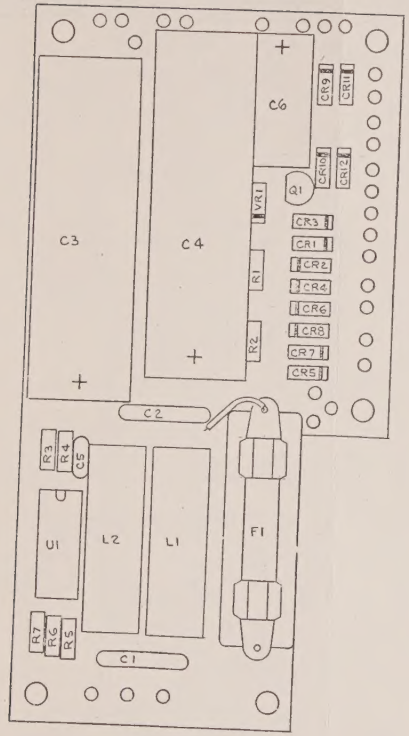
4. CIRCUIT CHANGES

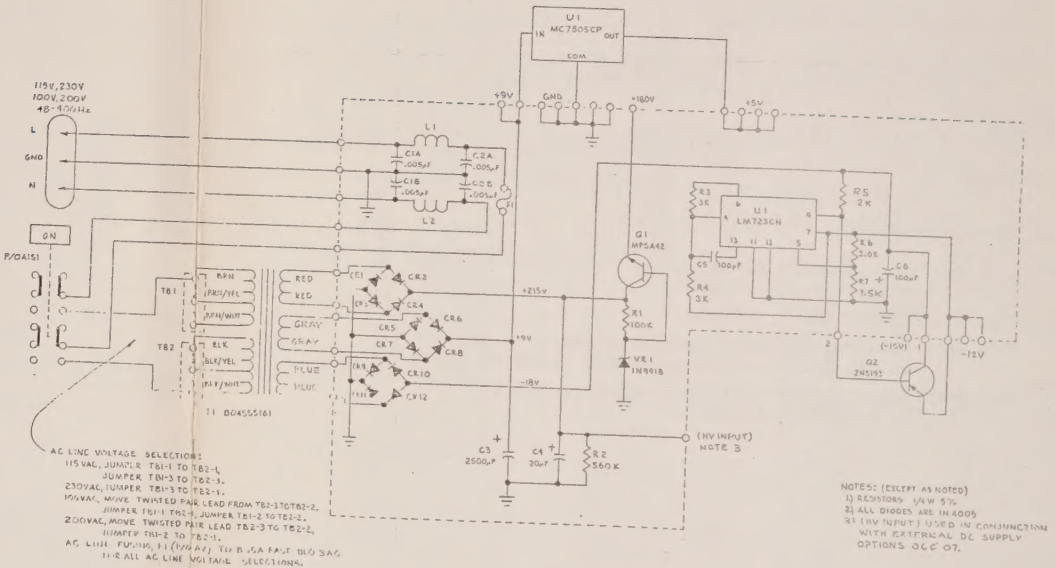
115 Vac, Jumper TB1-1 to TB2-1
Jumper TB1-3 to TB2-3

230 Vac, Jumper TB1-3 to TB2-1

100 Vac, Move twisted pair lead from TB2-3 to TB2-2
Jumper TB1-1 to TB2-1, Jumper TB1-2 to TB2-2

200 Vac, Move twisted pair lead TB2-3 to TB2-2
Jumper TB1-2 to TB2-1





POWER SUPPLY
ASSEMBLY #05367101 Rev B
SCHEMATIC #7-05367101 Rev C

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